

Fertilizer Use and Crop Yields



in the UNITED STATES



Agriculture Handbook No. 68
U. S. DEPARTMENT OF AGRICULTURE

Fertilizer Use and Crop Yields

in the UNITED STATES



The Fertilizer Work Group
National Soil and Fertilizer Research Committee

in cooperation with

The Soil and Water Conservation Research Branch

and the

Production Economics Research Branch

Agricultural Research Service

United States Department of Agriculture



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FOREWORD

The National Soil and Fertilizer Research Committee was organized in 1947 by memoranda of understanding among the State agricultural experiment stations in each Land-Grant College Region; the Soil Conservation Service; and the Office of Experiment Stations and the Soil and Water Conservation Research Branch, Agricultural Research Service, of the United States Department of Agriculture. The committee was directed to consider the national aspects of soils research and to advise the Experiment Station Section of the Land-Grant College Association and the United States Department of Agriculture on soil, fertilizer, and water research problems.

Most of the major activities of the national committee are carried on by work groups, appointed

from time to time to make special studies and prepare reports on matters of national interest.

This handbook is the result of studies conducted by the National Fertilizer Work Group, appointed in March 1951. During that year four regional reports analyzing crop production potentials in relation to the use of fertilizers were prepared. These were followed by a fifth report summarizing the data on a national basis. The five reports were then revised and combined into this report, which in final manuscript form was approved by each of the 48 cooperating State agricultural experiment stations for publication as a handbook by the Agricultural Research Service of the United States Department of Agriculture.

ACKNOWLEDGMENTS

The National Soil and Fertilizer Research Committee is grateful to the members of the Fertilizer Work Group for undertaking and completing this difficult assignment. The membership of the Work Group was as follows:

R. Q. Parks, Chairman, Soil and Water Conservation Research Branch, Agricultural Research Service, United States Department of Agriculture.

K. C. Berger, Wisconsin Agricultural Experiment Station.

W. E. Colwell, North Carolina Agricultural Experiment Station.

J. P. Conrad, California Agricultural Experiment Station.

Mack Drake, Massachusetts Agricultural Experiment Station.

D. B. Ibach, Production Economics Research Branch, Agricultural Research Service, United States Department of Agriculture.

The Work Group was assisted by A. L. Mehring, J. R. Adams, and L. B. Nelson, Soil and Water Conservation Research Branch.

L. B. Nelson succeeded R. Q. Parks as chairman of the Work Group after his resignation, April 1953. L. B. Nelson and J. R. Adams made the final revision of the tables and edited the text. A. L. Mehring spent a great amount of time and effort toward the preparation of the original reports, and in the early stages revised and consolidated them into bulletin form.

The research data contained in this handbook could not have been obtained without the whole-hearted cooperation of many soil scientists, agronomists, horticulturists, and agricultural economists throughout the country. One representative from each State was selected by the experiment station director and asked to assume responsibility for the summarization of all data for that State. These representatives were:

SOUTHERN STATES

Virginia.....	S. S. Obenshain
North Carolina.....	W. L. Nelson
South Carolina.....	W. R. Paden
Georgia.....	W. O. Collins
Florida.....	F. B. Smith
Kentucky.....	M. E. Weeks
Tennessee.....	O. H. Long

Alabama.....	R. D. Rouse
Mississippi.....	W. B. Andrews
Arkansas.....	D. A. Hinkle
Louisiana.....	M. B. Sturgis
Oklahoma.....	H. F. Murphy
Texas.....	J. F. Fudge

NORTH CENTRAL STATES

Ohio.....	G. W. Volk	Iowa.....	G. Stanford
Indiana.....	A. J. Ohlrogge	Missouri.....	A. W. Klemme
Illinois.....	A. L. Lang	North Dakota.....	E. B. Norum
Michigan.....	R. L. Cook	South Dakota.....	L. F. Puhr
Wisconsin.....	K. C. Berger	Nebraska.....	M. D. Weldon
Minnesota.....	C. O. Rost	Kansas.....	F. W. Smith

NORTHEASTERN STATES

Maine.....	G. L. Terman	New York.....	D. J. Lathwell
New Hampshire.....	L. T. Kardos	Pennsylvania.....	R. B. Pennington
Vermont.....	A. R. Midgley	New Jersey.....	E. R. Purvis
Massachusetts.....	W. G. Colby	Delaware.....	C. E. Phillips
Rhode Island.....	D. A. Schallock	Maryland.....	F. L. Bentz
Connecticut.....	{ B. A. Brown C. L. W. Swanson	West Virginia.....	G. G. Pohlman

WESTERN STATES

Washington.....	H. M. Reisenauer	Utah.....	H. B. Peterson
Oregon.....	R. A. Pendleton	Nevada.....	V. E. Spencer
Idaho.....	G. O. Baker	California.....	J. P. Conrad
Montana.....	J. A. Asleson	Arizona.....	W. T. McGeorge
Wyoming.....	M. Mortland	New Mexico.....	H. E. Dregne
Colorado.....	W. R. Schmehl		

Other members from each institution assisted the State representatives and the regional committees. Although it is not possible to mention each of those who contributed, special acknowledgment is due W. H. Allaway, J. W. Falloon, Arthur Hawkins, T. R. Swanback, M. T. Vittum, W. G. Colby, J. E. Steckel, E. R. Collins, F. S. Jamison, H. V. Jordan, W. G. Woltz, and R. W. Pearson.

January 1954.

W. H. GARMAN, Chairman
National Soil and Fertilizer
Research Committee

Fertilizer Use and Crop Yields in the United States

The National Soil and Fertilizer Research Committee, recognizing the crucial relationship of fertilizers to our national welfare, charged the Fertilizer Work Group with the responsibility of (1) assembling and analyzing experimental data relating to the fertilizer requirements of crops and soils and the crop responses to various rates of fertilization, and (2) providing State and Federal agencies with reports developed from this information.

In response, the Work Group prepared five preliminary reports. These involved collecting all of the available and usable data in the United States through 1950, showing the effect of different rates of fertilizer use on the principal crops. The data were summarized by States and regions, and nationally. The preliminary reports were given widespread distribution to State and Federal agencies and to the fertilizer industry. Initial use confirmed the value of this type of summary. Now, after thorough review and revision, the fertilizer data from

preliminary reports by States and regions have been combined.

This assignment represented the first attempt to make a nationwide summary of fertilizer-response data and to estimate changes in yield that might result from increases or decreases in fertilizer application rates. It has thus been an experiment in itself. Numerous gaps in information were encountered, and many differences of opinion had to be compromised.

The data as finally presented must be used and interpreted with caution. As will be pointed out later, the data are subject to certain limitations. It is believed, however, that the final tables present the most indicative picture possible on the basis of existing information. Any future summaries not only will have the benefit of this study but also that of a rapidly expanding inventory of fertilizer field experiments.

PROCEDURE

The United States was divided into four groups of States or regions—Southern, North Central, Northeastern, and Western—to facilitate division of work and to group information under more or less related conditions. Each Work Group representative was made responsible for the overall assemblage of data from his region. The Work Group representative was assisted by individual State representatives and these, in turn, by other crop and soil fertility specialists within the State.

All pertinent published and unpublished field fertilizer data through 1950 were summarized by principal crops, usually according to soils or geographic regions within a State. Yield response data then were selected for individual nutrients where yields were not limited by lack of other nutrients. From these, weighted summary curves (Form A response curves) were prepared on a statewide basis for each principal crop as shown by the example in figure 1. The Form A curves thus were a close expression of the data from field experiments.

The Form A curves from each State usually were reviewed by all of the State representatives within a region. This review frequently showed inconsistencies within the curves or omissions of certain crops and nutrients. In order to present a complete picture, the inconsistencies were corrected and the gaps filled by making a second set of curves called

Form B curves. The Form B curves thus were based on available data, plus the experience, observations, and combined judgment of the technical specialists of the State and region. Where experimental data were adequate, the Form A and Form B curves were interchangeable. In some States where data on a particular crop were lacking, Form B curves for parallel situations elsewhere were used to complete the tables.

The Form B curves were used as a basis in calculating the data presented in the tables (as illustrated by tables 12 and 13 on p. 16). Sources of this information and methods of calculation employed in developing these tables are given below.

Estimated average yield from given application rate of N, P₂O₅, and K₂O.—The estimated yields generally were read directly from the Form B curves for the designated nutrient application rate and for the yield under average nutrient (1950) use.

Some differences in procedure existed between the regional groups at the time the Form B curves were drawn, and these differences are reflected in the estimated yield tables. The Work Group representatives of the Southern, Northeastern, and Western States considered the data given in the Form B curves as yields at maximum operating efficiency levels, i. e., yields that were not limited by lack of other nutrients or reduced by plant diseases, insects,

FORM A
**STATE SUMMARY OF
EXPERIMENTAL DATA**
**FERTILIZER WORK GROUP
OF THE
NATIONAL SOIL AND FERTILIZER
RESEARCH COMMITTEE**

State: ALABAMA
 Crop: POTATOES
 Nutrient*: N P₂O₅ K₂O Lime
 (Check one)

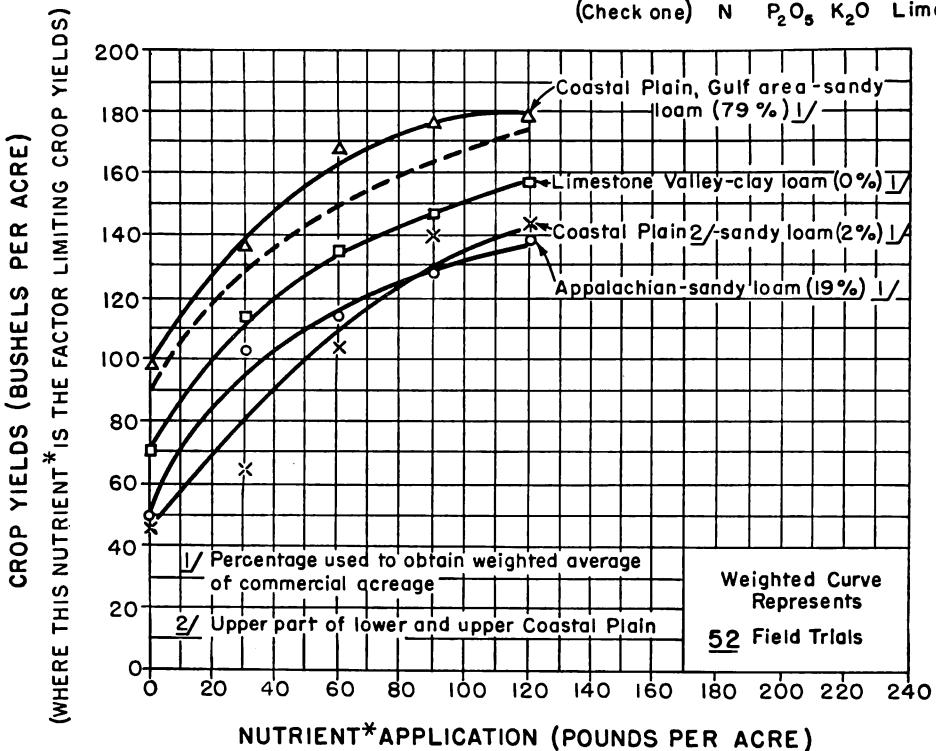


FIGURE 1.—Example, showing the preparation of a Form A response curve for nitrogen on potatoes in Alabama. The continuous lines are response curves for different areas of the State. The dashed line is the weighted summary, or Form A curve. Phosphorus or potassium did not limit the response to nitrogen in the data selected.

or other situations such as improper plant population, cultivation, drainage, and harvesting methods.

The Work Group representatives for the North Central States, on the other hand, believed that it would be impossible to maintain factors other than nutrients at maximum. Furthermore, they believed that yield data obtained from small plots are higher than under farm conditions, because experimental plots generally are given the more favorable locations in fields and, in addition, are not subject to normal harvesting losses. As a result, the North Central States adjusted their experimental yield data downward slightly when drawing the Form B curves. Thus, the North Central data given in the estimated yield tables may be somewhat conservative in comparison with other regions.

Planted acreage.—Obtained from “Estimated Consumption of Fertilizer by Crops During Year Ending June 30, 1950.” Production and Marketing Administration, U. S. Department of Agriculture. (Not available for distribution.)

Harvested acreage.—Obtained from “Agricultural Statistics, 1951.” U. S. Department of Agriculture.

Total production.—Obtained from “Agricultural Statistics, 1951.” U. S. Department of Agriculture.

Average yield.—The average yield is expressed in customary units and is obtained by dividing total production by total harvested acreage.

Average yield (percent of potential).—The average yield divided by the maximum estimated average yield for a given plant nutrient indicates the level of current operations or the percentage of the potential yield being obtained.

Total use (N, P₂O₅, or K₂O).—Obtained from “Estimated Consumption of Fertilizer by Crops During Year Ending June 30, 1950.” Production and Marketing Administration, U. S. Department of Agriculture. (Not available for distribution.) State fertilizer consumption figures are preliminary estimates and are not always in agreement with the figures given in the 1949–50 fertilizer consumption survey made by the Department of Agriculture. In some cases these figures have been modified where more complete information was available.

Average use (N, P₂O₅, or K₂O).—Total weight of nutrient divided by the planted acreage.

Planted acreage fertilized (N, P₂O₅, or K₂O).—Obtained from “Estimated Consumption of Fertilizer by Crops During Year Ending June 30, 1950.” Production and Marketing Administration, U. S.

Department of Agriculture. (Not available for distribution.)

Predicted percent change in yield with change in N, P₂O₅, or K₂O fertilizer rate.—The tabulated predicted percent change in yield with change in nutrient rate was estimated from the Form B curves. The average nutrient use was considered as zero percent change in application, and the corresponding crop yield read from the curve was taken as zero percent change in yield. Percent increases or decreases in crop yield over this figure were then determined for the other rates of nutrient application. Where no nutrient was applied, the change in application rate was -100 percent. In table 13, for example, 21 pounds of nitrogen per acre in Virginia gives an average yield of 49 bushels of corn. Increasing the nitrogen application 50 percent, or to 31.5 pounds per acre, would increase the yield 24 percent, or to 60.8 bushels. A decrease of 100 percent in the application rate of nitrogen (or no nitrogen) would cause a decrease of 44 percent in the crop

yield. This would mean a corn yield of only 27.4 bushels per acre with no nitrogen applied but with other factors, including phosphate and potash, at optimum levels.

In some of the newer fertilizer-using areas, however, current average rates of fertilizer use may be only 0.1 to 0.2 pound per acre. In such areas, a 200-percent increase in application rate gives no indication of the real potential that may be achieved from greatly increased fertilizer use. Thus, the percentages are of limited value in areas where very little fertilizer is being applied.

Weighted average for States reporting.—The data for estimated average yields, percentage of planted acreage fertilized with a nutrient, and predicted percent change in yield are all weighted on planted acreage basis. The data for average yield are weighted on a harvested acreage basis. Where data were missing for a given State, this State was not included in the weighting.

EVALUATION

As previously pointed out, the data given in the tables must be used and interpreted with caution. The reader, therefore, is urged to give this section careful study.

Although the tables represent what is believed the best evaluation possible from the basic experimental data, nevertheless there are certain limitations. The compilation was seriously handicapped by incomplete experimental data for various crops on many soils, and because some of the acreage estimates and current fertilizer usage data were not so precise as might be wished. Most States, however, have obtained considerable new and more pertinent data since 1950, which, if it could have been included, would have helped overcome this deficiency. The compilation was handicapped further in that the experimental data were not always adequate for predicting statewide effects. Many areas and soils within certain States have considerably different fertilizer needs than are shown by the weighted curves. Until such time as more accurate information can be obtained, the data must be used advisedly with these limitations in mind.

In Florida, for example, a soil and climatic situation exists that limits considerably the value of the data from that State. Most Florida farming is done on porous, sandy soils, and heavy and unpredictable rains may occur in all areas of the State. It is the custom and recommendation of Florida Experiment Station workers to take this into account, and two or more split applications of fertilizer are ordinarily recommended for row, tree, and pasture crop plants. The amount of fertilizer applied either on experiments or in farm practice, therefore, is governed by the current nutrient situation existing in the soil, which is greatly influenced by leaching. As a result, it has been almost impossible for the State to develop

valid Form B curves and the State workers have little confidence in the data for predicting yields.

In many of the Western States where fertilizer use and fertilizer research have been limited in the past, insufficient experimental data reduce the validity of that presented. Also, in several other States, including Mississippi, the State representatives questioned seriously the value of the data when weighted and placed on a statewide basis.

The study already has served a real purpose in pointing out gaps in information where additional research is needed.

The tables are of limited value in determining fertilizer ratios or grades for particular crops or situations, or for predicting relative quantities of two or more nutrients required to produce a given yield. The data presented for a given nutrient apply only to situations where adequate quantities of the other two nutrients were present. If interactions occurred between the nutrient in question and the other nutrients, the effect of these interactions is ascribed to the former. Thus, the combined effects of any two or all three nutrients cannot be predicted with sureness from the data. This could be done only if one assumed that there were no interactions.

Although the data show the possibilities of much larger crop production than presently exists, the reader should not associate the large yield potentials herein with overproduction of food. In addition to adequate amounts of fertilizers, best systems of management, disease and insect control, and use of high-yielding varieties will be required for maximum production.

This study was initiated at a time when the problem appeared to be one of imminent shortages of farm products. In view of rising trends in population without commensurate increases in land area

suitable for crops, the long range problem is one of meeting most economically the growing needs for additional output. But there is always a current need for determining the proper place of fertilizer, whether the short-time problem is one of shortages or of finding profitable outlets. When the problem is mainly the finding of profitable outlets, the job of balancing output to avoid surpluses and of managing use of resources to obtain highest total net returns is of paramount importance. Basic information on response to fertilizers over a wide range in rates of application is essential in making an intelligent approach to this problem. Only such information can provide the basis for determining the rates of application that would be most profitable in combination

with other yield-influencing practices. This determination can be of even more importance to farmers when the margin between gross returns and costs is narrow than when it is wide. At such times it is particularly important to maintain practices that contribute most to net returns.

The limitations and restrictions on the use of the data have been stressed, particularly in this introductory section. This has not been done to undermine the reader's faith in the report, but to acquaint him with the various pitfalls that might result from attempting to use the data for purposes for which they are not adapted. With a proper understanding of how the response data were derived, the report should prove of great value in numerous ways.

FERTILIZER USE BY REGIONS

SOUTHERN STATES

(Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas)

By W. E. COLWELL

Work Group Representative for the Southern States, and Head of Department of Agronomy, North Carolina State College of Agriculture and Engineering and the Agricultural Experiment Station of the University of North Carolina

CONSUMPTION DATA

The South is traditionally a heavy user of fertilizers, and in 1951 this region was still consuming 50 percent of the total fertilizer nutrients in the Nation. So dependent is the farmer of the humid South upon chemical fertilizers that he could not continue in production for long without them. Percentagewise, consumption has not increased as much as in other

regions, but the base tonnage in other parts of the Nation is small in comparison to that of the South. In terms of absolute quantities of plant nutrients, usage has been increased sharply during 1940-50. It is expected to increase rapidly during the next period of years (table 1).

TABLE 1.—*Estimates of quantities of commercial plant nutrients used in the Southern States in 1950 and those needed for level of production attainable in 1955*¹

State	1950			1955 attainable		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Virginia	Tons 26,862	Tons 80,906	Tons 43,723	Tons 35,877	Tons 104,159	Tons 63,568
North Carolina	92,148	146,276	104,142	133,200	211,567	199,268
South Carolina	52,126	72,756	48,243	81,644	123,133	89,735
Georgia	63,104	107,101	67,461	100,028	140,073	125,481
Florida	42,704	64,436	63,584	72,494	80,880	88,421
Kentucky	21,758	75,221	27,198	28,270	96,505	35,915
Tennessee	23,343	56,885	28,834	32,728	68,070	43,547
Alabama	61,711	97,669	53,047	106,283	126,475	86,393
Mississippi	84,961	46,395	23,807	157,031	95,874	48,540
Arkansas	38,700	35,500	23,550	66,416	76,873	48,025
Louisiana	30,155	25,261	12,084	40,634	30,562	14,101
Oklahoma	5,000	30,000	3,000	29,823	68,298	7,060
Texas	28,643	78,877	11,844	64,667	122,281	19,337
Total	571,215	917,283	510,517	949,095	1,344,750	869,391

¹ Estimates of quantities of commercial plant nutrients used in 1950 and of those needed for level and pattern of production attainable in 1955. U. S. Dept. Agr. Jan. 31, 1952. [Processed.]

The factors of climate and soils that were responsible for early use of fertilizer are the same factors that now call for still greater quantities for maximum production. For most crops grown extensively in the South, yields are only one-third to one-half the production potential. However, the average yields of tobacco and certain vegetable crops now approach the potential yield. These relatively high value crops receive heavy applications of plant nutrients through regular fertilization practices. In spite of relatively heavy fertilizer sales in the region, most crops are still greatly under-fertilized. The low average usage of fertilizer, as noted in table 2, may be related to the per capita income of the region, which is the lowest in the Nation.

The 1950 fertilizer consumption data, given in table 1, show that North Carolina, Georgia, and Alabama consume larger amounts of plant nutrients than the other States. Lowest consumers are Tennessee, Arkansas, Louisiana, Texas, and Oklahoma. Large parts of Texas and Oklahoma are semiarid to arid; hence, fertilizer use is limited.

For the region, in 1950, consumption of nutrients was divided as follows: N, 28.6 percent; P₂O₅, 45.9 percent; and K₂O, 25.5 percent. This proportion, however, varies between States, although North Carolina, South Carolina, Georgia, Alabama, and Tennessee approach the region's average. Kentucky and Virginia use less nitrogen and more phosphate, while Florida uses less phosphate and more potash. Mississippi, Arkansas, and Louisiana depend heavily on nitrogen. Texas and Oklahoma use more phosphate and less potash in their fertilizers than any of the other States.

More than 70 percent of all nutrients consumed in the region are as mixtures; however, this also

TABLE 2.—*Planted acreage and average use of N, P₂O₅, and K₂O for major crops in the Southern States during 1950*

Crops	Total acreage	Nutrients		
		N	P ₂ O ₅	K ₂ O
	1,000 acres	Lb./acre	Lb./acre	Lb./acre
Corn-----	25,556	15	13	9
Sorghum-----	8,185	.5	.6	.3
Wheat-----	14,364	2	4	12
Rye-----	506	5	14	6
Barley-----	532	8	18	8
Oats-----	6,727	8	8	6
Soybeans-----	2,215	1	8	6
Rice-----	1,368	11	8	4
Peanuts-----	2,812	3	14	9
Cotton-----	17,142	15	15	9
Tobacco-----	1,462	37	90	64
Sugarcane-----	353	31	6	14
Flaxseed-----	245	5	6	1
Potatoes-----	338	59	85	63
Vegetables-----	1,717	43	72	50
Fruits and nuts-----	1,891	42	45	49
Hay-----	11,113	2	11	4
Pasture and cover crops-----	155,343	.3	3	.8

varies among States, ranging from well over 80 percent in east coast States to less than 50 percent in Mississippi and in the western part of the region.

For the most part, the South derives its agricultural income from row crops, with corn, cotton, tobacco, peanuts, and soybeans predominating. Pasture improvement represents the best opportunity for greater income in the future. Even in the humid areas, average use of fertilizers on pasture and hay crops is remarkably low.

OPPORTUNITIES FOR MORE EFFICIENT FERTILIZER USE

Careful study of all the experimental data available in the southern region reveals some striking opportunities for higher production through greatly increased quantities of fertilizer, as indicated by table 3. Similarly, the data reveal situations where fertilizer rates may be safely reduced without impairing crop production.

Increased use of phosphate and potash on pasture and hay crops shows striking benefit. Yield increases of one-third can be expected on hay crops through the use of approximately 40 pounds P₂O₅ per acre, which is four times the current average rate. The same amount of potash will, on the average, also increase production by one-third. These facts, together with greatly expanding acres of improved hay and pasture in the South, are especially important in making future plans for fertilizer use in this region. The phenomenal returns from fertilizer applications on hay and pasture crops offer an opportunity to supplement farm income from cash crops by a livestock enterprise. Silage, haymaking,

and in-the-pasture accumulation of manure for the short winter season are all receiving widespread attention in the region.

In the region as a whole, corn represents a great opportunity. The average fertilization rate is 15 pounds N per acre, 13 pounds P₂O₅, and 9 pounds K₂O (table 2). Average yield is only 27 bushels per acre, and it is estimated that this is only 37 percent of the production potential. If State recommendations for nitrogen, for example, were followed throughout the area on the 26 million corn acres, nitrogen supplies would be inadequate even with the anticipated expansion of facilities.

Cotton is receiving only 15 pounds of nitrogen per acre on the average. Experimental data show this to be far below optimum. Production is only 45 percent of the potential.

Wheat planted on 14 million acres receives an average application of 2 pounds N per acre. If Oklahoma and Texas are not considered, the average rate is near 15. In certain parts of the South,

TABLE 3.—*Production potential of some major fertilizer-using crops in the Southern States and yields in 1950*

Crop and unit	Yield in 1950		Potential yield with full fertilization		Increase obtainable with full fertilization
	Average	Total for region	Average	Total for region	
Corn grain	bu.	27	Units/acre 1,000 units	73 1,726,214	1,087,515
Sorghum grain	bu.	23		32 209,425	58,639
Wheat	bu.	10		32 295,406	203,830
Rye	bu.	11		34 3,694	2,512
Barley	bu.	21		40 17,096	8,206
Oats	bu.	24		57 292,814	169,832
Soybeans	bu.	20		34 57,966	23,766
Peanuts	lb.	892	1,998,220	1,274 2,854,600	856,380
Cotton	lb.	255	4,060,000	567 9,022,000	4,962,000
Tobacco	lb.	1,271	1,811,114	1,513 2,156,088	344,974
Potatoes	bu.	128	43,027	217 72,927	29,900
Hay	tons	1.2	15,529	2.1 26,774	11,245

nitrogen rates of 60 to 75 pounds N per acre are recommended.

Economies in fertilizer use can be made in some places without materially affecting crop production. These are important to recognize, and a few will be pointed out. In general, phosphate applications can be reduced on fruits, vegetables, potatoes, tobacco, and certain specialty crops. Usually, the soils producing these crops have been heavily fertilized in the past. White potatoes, for example, are receiving 85 pounds P₂O₅ per acre. Vegetables, on the average, receive 72 pounds P₂O₅ per acre. On fruit trees the average rate is 45 pounds P₂O₅ per acre per year, with individual State averages going up as high as 92. Tobacco receives 90 pounds P₂O₅ per acre. Evidence at hand shows that a substantial saving of phosphate can be made on this crop without affecting yields appreciably.

In carrying forward the program of more efficient utilization of fertilizers, some markets for currently accepted grades will need to be abandoned. Greater efforts should be expended to develop new markets in line with the opportunities for maximum production as revealed by the crop-response data.

Although the data summarizing all current information are included in this report, it has seemed appropriate to call attention to a number of developments in the South that may well affect the interpretation of these figures, especially insofar as future use of fertilizer is concerned. This is done at the risk of omitting important considerations or overemphasizing others. It is hoped, however, that the bringing up of certain of these points for thought and analysis will contribute somewhat to a clearer understanding of the very important problem of fertilizer use in the South.

As supplemental irrigation becomes more widely practiced in the region, fertilizer rates will be stepped up. A sharp increase in areas to be irrigated is

anticipated. Much of this will undoubtedly be on heavily fertilized crops.

As methods develop for the control of insect pests and plant diseases, particularly some of the soil-borne diseases, factors previously limiting crop production will have been removed and new levels of fertilization will become practical.

Though fertilizer use may be expected to decline somewhat with falling prices, if such should prevail, there is at hand now more reliable data on crop response than there have been previously.

Credit agencies are making increased use of research findings. With an understanding of the true role of adequate fertilization and other cultural practices, it is expected that State recommendations will be followed reasonably closely by these agencies.

Wider use of soil-testing services and the increasingly greater confidence that can be placed in the interpretation of data will play a part in accelerating the rate at which shifts in fertilizer practices can be made. In many instances a soil may be particularly deficient in one fertilizer nutrient; soil tests are effective in pointing up this specific need. Soils in the South are generally acid, and increased usage of lime will make for more effective use of higher quantities of fertilizer.

Neighboring States are giving more attention to joint planning and interpreting of fertilizer experiments and matters pertaining to grades and ratios. This tends to unify somewhat the recommendations across State lines, with a correspondingly stronger educational impetus being given to any new grade or practice.

The introduction of high-analysis fertilizer materials, with a corresponding increase in average plant nutrient content in mixed fertilizers, may be expected to have a general effect of increasing the pounds of nutrients per acre. It may follow also that price per unit of plant nutrient will decline. Ad-

ditional sources of nitrogen for direct applications, such as anhydrous ammonia and nitrogen solutions, may provide nitrogen at a lower per-unit cost.

Continued expansion of southern pasture acreages is expected. This is essentially a new market.

With renewed emphasis on practical means of improving the physical conditions of soil, there is reason to believe that poor structural conditions may limit crop growth less frequently than has been the case in the past. If this is true, higher production ceilings with correspondingly higher usage of plant nutrients would be expected.

Throughout the region, State, Federal, and private plant breeders are developing improved crop varieties. In general, field experiments in the breeding programs are being conducted at high levels of fertility and not at the average level. This is frequently

reflected in varieties that excel at high-fertility levels.

Most States in the region have strong programs for better seed. As seed quality improves and crop stands are better, higher rates of fertilization become practical.

There is an increasing awareness on the part of agricultural leaders and farmers in the southern region that high fertilization and conservation of the capacity of the soil to produce go together. The concept of fertilizing the land for the rotation is prevailing over the concept of fertilizing the crop. The clear recognition of the part fertilizers play in a sustained high production may have a bearing upon their future use.

Data for the various crops by individual States are given in tables 12 through 40 (pp. 16 to 31).

NORTH CENTRAL STATES

(Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas)

By K. C. BERGER

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CONSUMPTION DATA

The North Central States contain some 225 million acres of cropland and probably have the greatest potential for increased fertilizer consumption of any region in the United States. These States produced 75 percent of the corn, slightly more than 54 percent of the wheat, 68 percent of the rye, 81 percent of the oats, 90 percent of the soybeans, and 47 percent of the hay in the Nation during 1950. Production of this magnitude exerts a heavy drain upon the nutrient supply in the soil.

Fertilizers have become an increasingly important factor in crop production in the North Central States during recent years. Consumption in 1941-50 has increased nearly threefold, with a total annual usage in 1951 of more than 4½ million tons. Undoubtedly, the consumption of fertilizers will continue to expand as crop production demands increase and as the native supplies of plant nutrients dwindle.

Considerable variation exists in the pattern of fertilizer nutrient consumption from one part of the region to another. Greatest consumption is in Ohio, Indiana, and Illinois (table 4). These three States used approximately 57 percent of all fertilizer nutrients consumed in the region in 1950. During the same year Michigan, Wisconsin, and Missouri each consumed about 8 percent, while Iowa and Minnesota each consumed between 5 and 6 percent. Consumption in the four Plains States was considerably less.

Although nitrogen consumption roughly parallels total fertilizer use, nevertheless considerable variation exists between States. With the exception of North Dakota, which uses relatively more phosphate

than nitrogen, the States in the western part of the region use a higher percentage of nitrogen in their fertilizer programs than do those to the east. Nebraska, for example, consumes considerably more nitrogen than either phosphate or potash. Kansas, South Dakota, Missouri, and Iowa also use a relatively high proportion of nitrogen.

Phosphate is used universally over the region, with the highest consumption in Ohio, Indiana, and Illinois. Except in Wisconsin and Nebraska, phosphate constitutes 50 percent or more of the total fertilizer nutrients applied.

Potash, on the other hand, presents a different picture. North Dakota, South Dakota, and Nebraska use practically none, and Kansas uses very little. Iowa and Illinois, also comparatively light potash consumers, applied only about 18 percent of the total nutrients in 1950 as potash. Wisconsin used more potash than phosphate. The other States are intermediate with potash consumption, ranging from 27 to 37 percent of the total nutrients consumed.

These variations in nutrient consumption reflect, in part, differences in climate, soils, and types of agriculture. In general, soils developed in areas of highest precipitation are more acid and leached and lower in available plant nutrients. On the other hand, those in the semiarid portions of the Plains States are frequently calcareous, often alkaline in reaction, and contain an abundance of potassium. Moisture is frequently a major limiting factor in plant growth. Although periods of drought may occur throughout the region, lack of moisture is common in the central and western parts of the four

TABLE 4.—*Estimates of quantities of commercial plant nutrients used in the North Central States in 1950 and those needed for level of production attainable in 1955*¹

State	1950			1955 attainable		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Ohio	Tons 28,860	Tons 117,512	Tons 81,520	Tons 46,585	Tons 144,409	Tons 100,115
Indiana	34,491	130,464	97,291	141,002	227,462	200,218
Illinois	15,804	201,055	48,688	46,340	283,760	95,086
Michigan	9,548	62,738	39,360	16,436	92,171	69,679
Wisconsin	12,671	49,601	51,243	45,162	105,702	116,250
Minnesota	6,465	41,542	20,992	12,010	63,950	31,975
Iowa	13,616	48,336	12,736	70,069	103,105	34,943
Missouri	21,865	52,641	28,047	90,000	130,000	70,000
North Dakota	884	6,037	40	4,179	17,575	150
South Dakota	501	1,347	40	7,134	10,768	0
Nebraska	12,450	1,495	0	67,960	16,580	0
Kansas	16,861	34,464	3,195	50,070	55,070	5,925
Total	174,016	747,232	383,152	596,947	1,250,552	724,341

¹ Estimates of quantities of commercial plant nutrients used in 1950 and of those needed for level and pattern of production attainable in 1955. U. S. Dept. Agr. Jan. 31, 1952. [Processed.]

Plains States and greatly influences crop response to fertilizers. As a general rule, going from north to south in the region is accompanied by a decrease in the organic matter content of the soils, except for variations brought about through differences in native vegetation. This undoubtedly has some influence on present nitrogen requirements.

The length of time the lands have been farmed and the type of farming practiced also have exerted their influence upon fertilizer needs and consumption. The States in the eastern part have been farmed longer than those elsewhere in the region, with a resultant greater depletion of native fertility. Dairy farming, such as is practiced in Wisconsin and other Northern States, results in a large loss of potash and nitrogen through improper handling of manure. The present large potassium requirements in Wisconsin probably are largely caused by this. Cash grain farming in the semiarid portions of the Plains States also has left its imprint. The combination of low yields and less intensive farming caused by lack of moisture, along with the practice of leaving crop residues on the land, has resulted in slower depletion of nutrients than elsewhere. Only recently has the original nitrogen supply of semiarid lands become depleted to the point where nitrogen responses have been observed.

Rates of fertilizer application vary with the crop grown (table 5). The average annual application rate in 1950 for the region as a whole was only 1.5 pounds of N, 6.8 pounds of P₂O₅, and 3.3 pounds of K₂O per acre. Heaviest fertilized crops are tobacco, vegetables, and potatoes. Cotton, fruits, and beets,

with relatively small acreages, also receive large amounts of fertilizer. Corn, wheat, rye, and oats receive about the same amounts of nutrients as the regional average for all crops. Hay, pasture, soybeans, barley, sorghum, and flax receive less.

About two-thirds of the total consumption of nutrients is in the form of mixtures.

TABLE 5.—*Planted acreage and average use of N, P₂O₅, and K₂O for major crops in the North Central States during 1950*

Crops	Total acreage	Nutrients		
		N	P ₂ O ₅	K ₂ O
	1,000 acres	Lb./acre	Lb./acre	Lb./acre
Corn	52,734	3	8	6
Sorghum	3,190	.5	.6	2
Wheat	40,132	2	7	6
Rye	904	1	8	4
Barley	6,407	.5	2	1
Oats	28,957	1	8	4
Soybeans	10,134	.4	3	3
Cotton	445	13	13	18
Tobacco	30	43	118	111
Sugar beets	351	8	37	26
Flaxseed	2,008	.5	3	2
Potatoes	565	9	37	40
Vegetables	956	12	42	34
Fruits	798	18	19	18
Hay	31,225	.5	7	2
Pasture and cover crops	50,248	.2	7	2

OPPORTUNITIES FOR MORE EFFICIENT FERTILIZER USE

Data given in tables 41 through 67 (pp. 32 to 47) show some interesting possibilities for increasing production through increased fertilizer use in the North Central States. Increased use of nitrogen particularly would improve yields for the region as a whole. For example, increasing the nitrogen application from the 1950 average to 40 pounds per acre would result in the following increases in yield: Corn, 31 percent; sorghum, 45; wheat, 41; rye, 47; barley, 41; oats, 43; flaxseed, 57; and potatoes, 30. Increases of lesser magnitude would be obtained with soybeans and tobacco. Bromegrass seed, fruits, and cotton would benefit greatly.

Increasing the rates of phosphate application over the average use would increase considerably yields of several crops—corn, wheat, rye, barley, oats, flaxseed, potatoes, vegetables, and hay, particularly—if large amounts were applied. Soybeans, sorghum grain, tobacco, cotton, sugar beets, fruits, and pastures would benefit only slightly.

Increasing the application of fertilizer nutrients on the currently high-fertilizer-using crop of tobacco would have the least effect on yields. Greater use of lime undoubtedly would increase the efficiency of fertilizers generally.

Production potentials of the North Central States for each of the major fertilizer-using crops show that in an average year with full fertilization, corn yields

could be increased from 44 to 67 bushels per acre for the entire region, an increase of more than 1 billion bushels a year (table 6). Yields of rye and hay could be more than doubled, wheat increased from 16 to 29 bushels per acre, barley from 24 to 34, oats from 38 to 63, soybeans from 23 to 36, and potatoes from 187 to 312 bushels per acre. The estimates of the North Central yield potentials are very conservative and reflect generally only the increase that could be expected from increased fertilizer use only.

The amount of fertilizer necessary to produce maximum yields is, of course, very large. In Wisconsin, for example, estimates indicate that the total tonnage required would be between 2 and 2½ million tons annually. Applications necessary for maximum yields, however, would be much less after high rates of application had been made for a few years, as evidenced by the buildup of available phosphorus in east coast soils. Recent Wisconsin experiments indicate that following high initial applications of phosphate and potash, the subsequent rates required are less. It is expected, however, that rather high annual applications of nitrogen will be required to maintain top yields.

If "all-out" food production becomes necessary, it is believed that adequate fertilization accompanied by other improved practices can double present yields for the region as a whole.

TABLE 6.—*Production potential of some major fertilizer-using crops in the North Central States and yields in 1950*

Crop and unit	Yield in 1950		Potential yield with full fertilization		Increase obtainable with full fertilization
	Average	Total for region	Average	Total for region	
Corn grain.....	bu--	<i>Units/acre</i>	<i>1,000 units</i>	<i>Units/acre</i>	<i>1,000 units</i>
Corn grain.....	bu--	44	2,095,653	67	3,175,232
Sorghum grain.....	bu--	24	42,568	32	56,757
Wheat.....	bu--	16	600,887	29	1,073,013
Rye.....	bu--	14	7,336	31	16,302
Barley.....	bu--	24	127,553	34	182,219
Oats.....	bu--	38	1,077,939	63	1,796,565
Soybeans.....	bu--	23	226,526	36	353,947
Cotton.....	lb--	298	128,000	828	356,000
Tobacco.....	lb--	2,457	37,460	3,413	52,028
Sugar beets.....	tons--	11	2,958	16	4,287
Flaxseed.....	bu--	11	19,480	14	24,049
Potatoes.....	bu--	187	104,328	312	173,880
Hay.....	tons--	1.3	53,960	3.3	138,359

NORTHEASTERN STATES

(Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, New Jersey, Delaware, Maryland, and West Virginia)

By
MACK DRAKE

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CONSUMPTION DATA

Fertilizers traditionally have played an important role in crop production in the Northeast. During recent years, more and more fertilizer is being applied; and, as indicated by this and other studies, considerably more fertilizer is needed to achieve the maximum production possible in the region. However, fertilizers are not now being used to their maximum efficiency. Certain changes in methods of fertilizer application, in the amounts and kinds of nutrients used on different crops, and in liming and other contributing practices will undoubtedly improve the efficiency of fertilizer use. Furthermore, the emphasis on overall fertilizer use will shift as important changes in the agriculture of the region occur.

At present, dairying, general livestock, and fruit, vegetable, potato, and tobacco growing are important types of farming in the Northeast. Forage crops, corn, and small grains are grown on both general livestock and dairy farms. More than 65 percent of the farmland is in hay and pasture, either rotated or permanent. Many farms, however, are replacing corn silage with grass silage, especially in the six New England States. Acreage of superior legume-grass mixtures is increasing.

Fertilizer needs are associated closely with the soils and their properties. Many soils of the region are low in natural fertility and many soils are low in organic matter. Many of the soils also have a low water-holding capacity, and lack of moisture often limits production during periods of low rainfall. As a result, supplemental irrigation may be needed for maximum production. Nearly all of the soils of the region are acid and require periodic applications of limestone for most crops. Lime is essential for efficient utilization of fertilizer nutrients on most of the soils.

The average annual fertilizer application rate for 1950 was 5.5 pounds of N, 16.5 pounds of P₂O₅, and 9.7 pounds of K₂O per acre. However, these average values may be misleading, since many intensively cultivated crops, as tobacco, potatoes, and vegetables (table 7), receive very high applications of fertilizer. Corn and small grains and limited acreages of improved forage mixtures receive moderate applications of fertilizers, but a very large acreage of hay and pasture received little fertilizer.

For years farmers in the Northeast have made heavy applications of phosphate to areas in potatoes,

vegetables, and other high acre-value crops. Experimental data, however, show that on areas that have been well fertilized for many years, these crops may still respond to applications of phosphate fertilizer. Because soils of the Northeast are high in active iron and aluminum, they have very high phosphorus-fixation capacities. Fixation of applied phosphorus into forms relatively unavailable to plants presents a serious problem. The common practice of using superphosphate in the dairy gutter and on manure reduces phosphorus fixation to a minimum and also reduces nitrogen losses from the manure. Many of the decomposition products from organic matter inactivate iron and aluminum, thereby increasing phosphorus availability.

TABLE 7.—*Planted acreage and average use of N, P₂O₅, and K₂O for major crops in the Northeastern States during 1950*

Crops	Total acreage	Nutrients		
		N	P ₂ O ₅	K ₂ O
	1,000 acres	Lb./acre	Lb./acre	Lb./acre
Corn grain	3,195	14	34	20
Corn silage	142	11	29	14
Wheat	1,880	10	42	22
Rye	307	6	27	6
Barley	344	9	40	17
Oats	2,079	6	31	14
Buckwheat	93	2	32	5
Soybeans	202	4	27	23
Tobacco	119	76	79	130
Potatoes	472	83	156	178
Vegetables	823	68	129	92
Dry beans and peas	169	8	17	9
Fruits	640	20	10	9
Legume-grass hay and pasture	10,295	1	7	4
Permanent grass hay and pasture	12,868	.4	5	2

Lack of nitrogen is a serious problem in crop production over most of the region. This problem is the result of several factors. Low organic-matter content of sandy soils and relatively high rainfall, especially during the fall and spring, cause serious annual loss of nitrates by leaching. Also, many of the soils are low in lime, phosphorus, and potassium

so that grasses crowd out legumes to the extent that many areas are referred to as "natural grasslands." Legumes generally are an inadequate source of nitrogen in all types of farming if maximum production is to be achieved. With many intensively cultivated crops such as vegetables, legumes supply only a small part of the nitrogen requirements. Even with legume-grass associations, varying amounts of applied nitrogen are needed for maximum produc-

tion, particularly in establishing new seedlings on soils low in nitrogen and where there is a low ratio of legume to grass.

The total amount of fertilizer nutrients consumed by different States in 1950 is most closely related to the total agricultural acreage of the State (table 8) and hence does not reflect differences in usage. More than 80 percent of the fertilizer applied is mixtures.

TABLE 8.—*Estimates of quantities of commercial plant nutrients used in the Northeastern States in 1950 and those needed for level of production attainable in 1955¹*

State	1950			1955 attainable		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Maine-----	Tons 12,870	Tons 20,593	Tons 22,470	Tons 15,980	Tons 25,307	Tons 26,587
New Hampshire-----	836	3,837	2,171	1,082	5,150	2,842
Vermont-----	1,521	6,911	3,758	2,323	10,414	6,032
Massachusetts-----	4,417	8,875	6,422	4,465	9,189	6,519
Rhode Island-----	649	1,554	1,337	877	1,730	1,556
Connecticut-----	6,612	8,277	8,046	7,963	10,567	10,688
New York-----	23,913	81,888	34,053	33,000	90,000	40,000
Pennsylvania-----	20,611	83,820	41,332	27,191	113,967	98,087
New Jersey-----	11,951	24,953	20,890	18,964	44,731	45,811
Delaware-----	2,089	6,650	4,886	3,048	7,213	6,098
Maryland-----	6,319	30,252	17,351	21,433	74,054	47,094
West Virginia-----	2,250	17,000	4,450	3,700	24,500	6,200
Total-----	94,038	294,610	167,166	140,026	416,822	297,514

¹ Estimates of quantities of commercial plant nutrients used in 1950 and of those needed for level and pattern of production attainable in 1955. U. S. Dept. Agr. Jan. 31, 1952. [Processed.]

OPPORTUNITIES FOR MORE EFFICIENT FERTILIZER USE

Production of higher yields and improved quality forage on fewer acres seems to be a sound objective. The largest potential for increased fertilizer use in the region is on forage crops. Table 9 shows that it is possible to double yields of superior legume-grass mixtures in the northeastern region by adequate fertilization. Adequate fertilization of permanent grass likewise will produce large increases in forage yields. Such increases in forage production are needed in the Northeast to help the dairy industry reduce production costs and to keep pace with the growing population.

The annual average use of fertilizer nitrogen for the region's 12.8 million acres of permanent grass is only 0.4 pound per acre. On most farms permanent grass does not receive much manure. Increasing the nitrogen rate to 40 pounds per acre on half this acreage, together with adequate lime, phosphorus, and potash, would increase grass production 50 percent, or the equivalent of an added 4 million acres of land. However, this would require 110,000 additional tons of nitrogen, which would double the nitrogen consumption for the Northeast.

Increasing the phosphate and potash use on mixed legume-grass also offers striking possibilities. The

1950 average use was only 7 pounds of P₂O₅ per acre on 10 million acres of improved legume-grass. Increasing the rate to 40 pounds of P₂O₅ per acre with adequate nitrogen, potash, and lime would increase the yield of improved legume-grass hay by 18 percent or the equivalent of an added 1.8 million acres of hay land. However, 165,000 additional tons of P₂O₅ would be required, which is more than half of all the phosphate now used in this region. This 18 percent increase in yield of improved legume-grass would also require increasing the use of potash from 4 pounds per acre used in 1950 to 40 pounds K₂O per acre. For the 10 million acres, this increased potash requirement is 180,000 tons K₂O, which would double the present potash use in this region. Large quantities of lime would also be required.

Grain crops also would profit from increased fertilizer use in most of the States. Greatest improvement in grain yields would come from increased use of nitrogen and, to a lesser extent, from potash. Increasing phosphate rates would be of the least benefit. For example, corn grain yields could be increased approximately 32 percent by raising the nitrogen application rate from the current 14 pounds per acre to 80. Raising the average use of nitrogen

TABLE 9.—*Production potential of some major fertilizer-using crops in the Northeastern States and yields in 1950*

Crop and unit	Yield in 1950		Potential yield with full fertilization		Increase obtainable with full fertilization
	Average	Total for region	Average	Total for region	
Corn grain.....bu.	Units/acre 43	1,000 units 96,452	Units/acre 98	1,000 units 219,209	1,000 units 122,757
Corn silage.....tons	10	1,367	11	1,470	103
Wheat.....bu.	23	41,790	35	63,318	21,528
Rye.....bu.	16	1,339	33	2,790	1,451
Barley.....bu.	33	12,442	43	16,371	3,929
Oats.....bu.	40	75,885	57	108,407	32,522
Soybeans.....bu.	16	1,963	26	3,166	1,203
Tobacco.....lb.	1,215	145,831	1,642	197,069	51,238
Potatoes.....bu.	310	141,486	508	231,944	90,458
Legume-grass hay and pasture.....tons	1.4	15,720	2.8	31,440	15,720

to 40 pounds per acre would increase wheat yields 26 percent; rye, 29 percent; and barley and oats, 33 percent. With potash, corn grain yields could be increased about 15 percent by increasing the K₂O rate from the current 20 pounds per acre to 80. Increasing the K₂O rate to 40 pounds would increase wheat yields 9 percent; rye, 13 percent; barley and oats, 8 percent. More phosphate, however, would not materially benefit corn, wheat, and rye in most of the States. Barley and oat yields would benefit to some extent.

The survey indicates that yields of corn silage could be increased from greater use of each of the three nutrients; particularly, if the rates were increased materially. Buckwheat in Pennsylvania could profit from greater use of nitrogen and potash but not from phosphate. With soybeans, too few data are available to predict the effect of increasing nitrogen. More potash, however, would be of real benefit, while more phosphate appears desirable in some States.

Tobacco, already a heavily fertilized crop, might benefit from increased use of nitrogen and phosphate in some States. Potatoes are receiving near maximum nitrogen fertilization in Maine, Rhode Island, and Maryland; but more nitrogen appears desirable elsewhere. Only Vermont and West Virginia might benefit from greater usage of phosphate on potatoes. More potash, which is now applied at an annual rate of about 178 pounds of K₂O per acre, would not be expected to increase potato yields further.

Increased nitrogen use on fruits would materially benefit yields, but there appears to be little need for

increasing the use of phosphate. Increased use of potash would improve color and quality of apples.

Important reductions in fertilizer use on heavily fertilized crops in some States might be accomplished without serious reduction in yields. For example, a 25-percent reduction could be made in phosphate on potatoes in Maine, Rhode Island, and New York, and in potash on potatoes in Maine, Rhode Island, Connecticut, New York, Pennsylvania, Delaware, and possibly New Jersey.

The production potential of some of the major fertilizer-using crops of the region is given in table 9. Yields and total production of corn grain, rye, hay, and permanent grasses could be approximately doubled. Similarly, wheat, soybeans, and potatoes could be increased 33 percent or more; barley, oats, and tobacco by approximately 25 percent; and corn silage by 10 percent.

In addition to the present and future prominence of commercial fertilizers in the region, it is important to recognize that on dairy, livestock, and poultry farms, a large amount of the plant nutrients comes from manure. More efficient and effective use of manure would benefit crop production and reduce somewhat the dependence upon fertilizers. At present, large amounts of poultry manure high in nutrients are wasted each year because of problems in transporting and handling. Also, a high percentage of the nutrients are lost from dairy manures through improper management and loss of the liquid fraction.

Data for the various crops by individual States are given in tables 68 through 92 (pp. 48 to 61).

WESTERN STATES

(Washington, Oregon, Idaho, Montana, Wyoming, Colorado, Utah, Nevada, California, Arizona, and New Mexico)

By JOHN P. CONRAD

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CONSUMPTION DATA

In the 11 Western States, which comprise about one-third of the land area of the continental United States, past geological forces have produced much sharper relief than in other regions of the country. Many of the mountains are higher and more rugged and the valleys and canyons deeper. In consequence, climate may change abruptly from place to place, brought about in part by the resulting differences in elevation as well as by the particular configuration of the hills and mountains themselves. High mountain valleys may be subject to frost any month of the year, while other locations have frosts only in occasional years. Along the Pacific Ocean summer temperatures are usually cool because of fogs, while beyond the Coast Range in the interior the temperatures may be 30° to 40° F. higher. Winters in the interior are usually colder than on the coast. Rainfall varies from 2 inches to more than 100 inches per year, coming mainly in the winter.

Along with the great variations in climate, the fertility of the soil varies markedly within short distances, often in the same orchard, pasture, or field. As a result of the geological formations exposed to weathering and erosion, the parent materials of the western soils vary widely. Differences in the duration of weathering, in topography, and in plant cover (together with other biological factors) in addition to the variations in climate have produced soils showing marked differences in pH, in the presence of alkali, salines, or other toxic substances and in the relative ability of each soil to furnish nutrients to the crops being grown. As a whole, soils in the Western States are deeper, are less leached during development, and have been farmed for a shorter time than soils elsewhere. In consequence, the depletion of their virgin fertility, except for nitrogen, has usually not progressed as far as elsewhere, nor has this depletion been uniform. Local areas do occur, however, where deficiencies are just as acute as anywhere else.

Throughout the West, droughts of about 6 months' duration are usual. Many areas are desert. Before irrigation, moisture rather than plant nutrients was, in general, the most deficient factor in crop production. Irrigation development during the last 100 years has gradually brought intensive production to important segments of the region. Typically, part of a valley may have been irrigated early. Subsequently and progressively, other areas within the valley may have become irrigated. In some sections at least, moisture had been the limiting factor and

from a fertility standpoint these lands were almost virgin at the start of irrigating. Other lands when first irrigated have, however, shown signs of nutrient deficiencies from the start.

With the completion of the transcontinental railroads and the realization that many areas of the West could produce fruits and vegetables of good quality "out of season" suitable for shipment to the eastern markets, there has been a marked increase in acreages planted to these crops—first in citrus, then in deciduous fruit, and somewhat later in vegetables.

Historically, growers of these crops with their high per-acre gross returns have applied adequate to more-than-adequate amounts of fertilizers to obtain reasonable responses in yield and quality of product. As a result, the use of nitrogen except on the most fertile soils has become widespread with these crops. However, experimentation, aided by visual deficiency symptoms and at times by laboratory tests, has demonstrated that many local areas need one or more of the following elements to give crop responses: Zinc, phosphorus, potassium, boron, manganese, copper, iron, and magnesium. In fact, the application of zinc in California and in the Columbia Basin is second only to nitrogen in supplying nutrients to increase yields of certain crops.

At present, there is a large acreage used for small grains, including wheat, barley, and oats, that is usually dry-farmed by planting in the fall and winter and where the period of growth normally extends into the dry summers. These crops have generally been grown by the fallowing system of 1 year (or more accurately a summer) of cultivated fallow followed by the planted small grains the next year. Recently, in some areas other crops, including legumes, have been planted "on the fallow." Irrigated rice as a summer crop is locally important in California.

In recent years cotton, mostly under irrigation, has become an important crop, especially in Arizona, California, and New Mexico. The staple crops—corn, sugar beets, dry beans, and peas—are generally irrigated. In many States seed crops and mint, hops, and other specialty crops are being produced. Hay and pasture—both irrigated and nonirrigated—are important.

Historically, growers of these field crops have depended largely on the original fertility of the soil. As dry farmed grain yields progressively declined, intervening pasture or fallow for one or more years was used. The virgin nitrogen supply was aug-

TABLE 10.—*Estimates of quantities of commercial plant nutrients used in Western States in 1950 and those needed for level of production attainable in 1955¹*

State	1950			1955 attainable		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Montana.....	Tons 1,943	Tons 4,370	Tons 45	Tons 4,676	Tons 9,930	Tons 90
Idaho.....	9,006	20,760	555	14,950	26,276	555
Wyoming.....	386	1,752	0	2,320	3,839	0
Colorado.....	2,432	6,350	0	6,116	10,271	0
New Mexico.....	2,208	4,048	40	7,490	8,663	40
Arizona.....	18,068	8,779	2,185	27,245	13,115	2,185
Utah.....	2,286	2,453	0	4,893	4,339	0
Nevada.....	131	550	0	876	2,476	0
Washington.....	8,839	9,743	3,443	23,328	12,733	3,988
Oregon.....	15,783	10,594	2,557	27,018	15,556	4,659
California.....	125,653	59,867	12,216	171,985	101,509	13,379
Total.....	186,735	129,266	21,041	290,897	208,707	24,896

¹ Estimates of quantities of commercial plant nutrients used in 1950 and of those needed for level and pattern of production attainable in 1955. U. S. Dept. Agr. Jan. 31, 1952. [Processed.]

mented by leguminous crops. Under irrigation alfalfa and other legumes in the rotation were generally depended on to maintain the nitrogen supply, and applications of non-nitrogenous fertilizers were added as deemed necessary to keep the legumes in relatively high production. Carriers of sulfur, phosphorus, potassium, boron, and other nutrients have been used at various times and places in this program.

Fertilizer consumption in the West always has remained considerably below that of the other regions. Consumption, however, has been increasing rapidly since the late 1930's, particularly for nitrogen and phosphate. State consumption of fertilizer depends on the acreage of farmlands within the State and the intensity and type of agriculture practiced. California, with more than 5 million acres of irrigated land, traditionally has been the big user, consuming approximately 59 percent of all of the fertilizer nutrients in the West in 1950. Idaho, Arizona, and Oregon each consumed approximately 9 percent; Washington, 6 percent; Colorado, Montana, and New Mexico, each 2 percent; Utah, 1 percent; and Wyoming and Nevada, each less than 1 percent.

For the West as a whole, nitrogen consumption is about double that of phosphate. Considerably more nitrogen than phosphate is used in California, Arizona, and Oregon; about an equal amount in Utah and Washington. However, considerably more phosphate than nitrogen is used in Idaho, Montana, Wyoming, Colorado, New Mexico, and Nevada. Potash consumption is low and limited largely to California, Oregon, Washington, and Arizona.

Highest per-acre use of fertilizers is on the high-

cash crops, such as cotton, sugar beets, potatoes, fruits and nuts, vegetables, rice, and seed and specialty crops (table 11). Grains, hay, and dry beans and peas receive the least.

The pattern of nutrient consumption as mixed fertilizers and as straight materials in the West differs considerably from the other regions. Only about 25 percent of the total consumption of nutrients is in the form of mixtures, as compared with 75 percent in the other States.

TABLE 11.—*Planted acreage and average use of N, P₂O₅, and K₂O for major crops in the Western States during 1950*

Crops	Total acreage	Nutrients		
		N	P ₂ O ₅	K ₂ O
Corn grain.....	1,000 acres 723	Lb./acre 4	Lb./acre 4	Lb./acre 2
Wheat.....	14,575	1	.7	.07
Barley.....	5,331	5	1	.1
Oats.....	2,092	1	1	.07
Sorghum grain.....	214	10	5	3
Rice.....	250	31	.1	.004
Cotton.....	1,062	50	14	.5
Sugar beets.....	665	45	38	4
Potatoes.....	454	44	34	10
Dry beans and peas.....	647	3	4	-----
Fruits and nuts.....	1,897	58	11	5
Seed and specialty crops.....	521	37	11	3
Vegetables.....	1,029	54	42	19
Hay.....	8,772	1	8	.2
Pasture and cover crops.....	3,526	5	8	.5

OPPORTUNITIES FOR MORE EFFICIENT FERTILIZER USE

Scrutiny of the data in tables 93 to 115 (pp. 62 to 75) shows some possibilities for expansion of fertilizer consumption and, to a lesser extent, for increasing the efficiency of its use. No blanket statements relating responses to rates of application of a fertilizer may be made that will be applicable to all lands in a given crop on a regional basis. Local areas within the region have possibilities of substantial increases from the use of appropriate fertilizers on field crops. In general, the nutrient needs of the high-costs-per-acre vegetable, fruit, and nut crops are being adequately met, or nearly so, though in some areas there are undoubtedly opportunities for some substantial increases with these crops.

Not all nonlegume crops respond to nitrogen on all soils, but nitrogen deficiencies are very general

over the West. Substantial percentage increases from applications of nitrogen on corn, cotton, hay, small grains, and sugar beets can be made in various areas throughout the West. Phosphorous deficiencies are not universal, but, where encountered, may be acute.

Various hay and pasture legumes may show substantial response to phosphorus in certain areas within the Western States. Other crops such as hay- and pasture-nonlegumes, vegetables, potatoes, and cotton may need adequate nitrogen before these crops will give maximum responses to phosphate applications.

Potash-deficient areas are infrequently found, but when encountered may be as serious for many crops as any other nutrient deficiency.

CROP RESPONSE TABLES

(Nos. 12-115)

SOUTHERN STATES

TABLE 12.—*Corn grain in the southern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okl.	Tex.	Weighted average for States reporting
Nitrogen rate:														
160		94				74								89
120	92	86	74	60	74	60		63	75	76	74			71
80	76	70	61	55	64	55	90	55	62	65	62			63
40	52	52	48	49	48	49	72	40	45	49	46	51		50
20	37	40	40	36	38	42	62	30	34	35	36	42		40
10	28	34	33	25	30	38	56	23	29	29	31	38		33
0	19	26	25	15	20	34	52	14	24	22	26	32		26
Average use (cf. table 13)	37	48	40	29	30	35	56	27	39	34	34	41		37
Phosphoric oxide rate:														
160						74	72							
120		74	95	65		74	68							72
80	68	94	56	40	74	62	57							58
40	60	90	46	31	60	48	55	68	61		62	46		55
20	55	83	34	22	45	36	52	62	56	55	57	44		48
10	52	80	28	16	35	29	50	58	54	51	55	42		44
0	49	76	22	9	25	20	48	52	51	45	52	40		39
Average use (cf. table 13)	57	85	34	19	33	30	50	62	52	48	53	41		45
Potash rate:														
160		90				74	67							78
120		90				74	65							77
80	90	68	46	65	62	62	55							62
40	70	86	60	32	60	57	60	54	75		80	49		58
20	62	76	54	20	50	51	58	53	72	52	74	48		53
10	58	72	50	13	45	47	56	51	70	43	72	48		49
0	54	68	45	8	40	42	55	48	69	31	68	47		46
Average use (cf. table 13)	63	76	52	14	43	45	56	51	70	37	69	47		49

TABLE 13.—*Corn grain in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okl.	Tex.	Weighted average for States reporting
Acreages and yields:														
Planted acreage..... 1,000 acres	1,128	2,214	1,452	3,500	719	2,396	2,153	2,845	2,357	1,418	866	1,334	3,174	25,556
Harvested acreage..... do	1,053	2,149	1,403	3,049	491	2,087	2,072	2,643	2,220	1,394	830	1,239	3,070	23,700
Total production..... 1,000 bushels	51,567	78,513	32,269	50,308	6,874	77,219	70,448	59,488	58,830	37,638	19,090	30,975	64,470	638,699
Average yield..... bushels per acre	49	37	23	16	14	37	34	22	26	27	23	25	21	27
Do..... percent of potential	53	39	31	27	19	51	38	32	35	36	29	48	36	37
Nitrogen:														
Total use..... short tons	11,640	38,709	15,028	25,270	3,595	3,176	7,480	25,490	34,891	12,762	7,126	1,940	3,995	191,102
Average use..... pounds per acre	21	35	21	14	10	3	7	18	30	18	16	3	2	15
Planted acreage fertilized with N..... percent	86	76	90	95	40	26	72	92	80	60	75	36	10	65
Change in application rate, percent:														
+200	+80	+68	+40	+48	+47	+5	+12	+75	+68	+67	+47	+9	+6	+42
+100	+47	+36	+20	+34	+27	+2	+6	+45	+39	+37	+24	+5	+4	+25
+50	+24	+19	+10	+21	+13	+1	+3	+25	+19	+16	+11	+2	+3	+13
+25	+11	+12	+7	+12	+7	+8	+2	+18	+10	+9	+6	+1	+1	+8
+10	+4	+4	+5	+4	+5	+2	+1	+11	+4	+1	+3	+5	+2	+3
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-4	-4	-5	-9	-2	-3	-4	-3	-4	-4	-9	-6	-6	-3
-25	-11	-8	-10	-14	-8	-9	-1	-7	-9	-10	-5	-1	-1	-7
-50	-24	-21	-17	-28	-13	-2	-3	-16	-20	-16	-11	-3	-2	-14
-100, no application	-44	-46	-38	-54	-33	-4	-6	-48	-39	-33	-23	-4	-3	-29
Phosphoric oxide:														
Total use..... short tons	19,400	29,453	13,721	26,600	2,876	15,000	12,240	25,605	5,658	4,254	1,900	2,910	3,184	162,801
Average use..... pounds per acre	34	27	19	15	8	12	11	18	5	6	4	4	2	13
Planted acreage fertilized with P ₂ O ₅ percent	86	76	90	95	40	42	72	92	80	60	75	36	10	66
Change in application rate, percent:														
+200	+23	+9	+52	+74	+45	+55	+7	+10	+5	+12	+4	+1	+2	+25
+100	+14	+6	+32	+41	+27	+33	+3	+10	+2	+6	+2	+1	+1	+15
+50	+7	+5	+14	+27	+12	+17	+2	+6	+1	+3	+1	+5	+7	+8
+25	+4	+2	+6	+18	+6	+8	+1	+3	+7	+1	+3	+4	+2	+5
+10	+1	+1	+3	+8	+2	+5	+4	+1	+3	+6	+1	+2	+1	+2
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-1	-1	-3	-3	-2	-3	-4	-1	-2	-2	-2	-2	-3	-1
-25	-4	-2	-8	-9	-6	-7	-1	-3	-4	-2	-2	-5	-6	-4
-50	-8	-7	-17	-24	-12	-15	-2	-7	-1	-4	-2	-9	-8	-8
-100, no application	-16	-13	-37	-53	-24	-33	-3	-16	-3	-7	-3	-2	-1	-18
Potash:														
Total use..... short tons	12,125	21,879	9,801	19,950	2,157	7,300	8,160	14,225	4,715	3,829	900	1,212	786	107,039
Average use..... pounds per acre	22	20	14	11	6	6	8	10	4	5	2	2	.5	9
Planted acreage fertilized with K ₂ O..... percent	86	76	90	95	40	30	72	92	80	60	75	36	10	65
Change in application rate, percent:														
+200	+12	+12	+16	+107	+16	+12	+4	+6	+1	+28	+1	+1	+0.2	+21
+100	+11	+8	+10	+57	+9	+6	+2	+4	+.7	+13	+8	+9	+0.6	+12
+50	+6	+4	+6	+31	+4	+3	+.9	+2	+4	+7	+5	+6	+0.4	+6
+25	+3	+2	+2	+24	+2	+2	+5	+7	+2	+3	+4	+4	+0.2	+4

Predicted percent change in yield with change in K₂O fertilizer rate

FERTILIZER USE AND CROP YIELDS

TABLE 14.—*Sorghum grain in the southern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	N. C.	S. C.	Ga.	Tenn.	Ala.	Tex.	Weighted average for States reporting
Nitrogen rate:							
160							
120	75						75
80	68						68
40	55		80	85	55	32	33
20	42	52	71	76	53	28	29
10	32	40	64	66	48	25	26
0	21	22	52	52	42	22	22
Average use (cf. table 15)	58	32	58	64	52	22	33
Phosphoric oxide rate:							
160							
120							
80	79						79
40	71	97	89	79	56	29	30
20	56	93	88	67	55	28	29
10	43	88	84	58	53	27	28
0	29	81	80	48	51	26	27
Average use (cf. table 15)	62	92	84	68	54	26	27
Potash rate:							
160							
120							
80							
40	46	69	99	80	54	28	29
20	41	63	96	83	53	27	28
10	38	56	93	80	52	26	27
0	32	46	86	73	50	25	26
Average use (cf. table 15)	41	56	91	82	52	25	26

TABLE 15.—*Sorghum grain in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	N. C.	S. C.	Ga.	Tenn.	Ala.	Tex.	Weighted average for States reporting
Acreages and yields:							
Planted acreage..... 1,000 acres..	49	25	42	34	77	7,958	8,185
Harvested acreage, 1,000 acres:							
Grain.....	29	8			44	6,474	6,555
Silage.....		2	5	7	5	79	98
Forage.....	16	18	25	21	25	1,687	1,792
Sirup.....	10	6	12	9	13	4	54
Total.....	55	34	42	37	87	8,244	8,499
Total production:							
Grain..... 1,000 bushels..	870	152			946	148,818	150,786
Silage..... 1,000 tons..		10	25	52	35	364	486
Forage..... do.....	35	27	34	44	35	2,271	2,446
Sirup..... 1,000 gallons..	720	318	672	640	858	200	3,308
Average yield:							
Grain..... bushels per acre..	30	19			22	23	23
Silage..... tons per acre..		5	8	7	5	5	5
Forage..... do.....	2	2	1	2	1	1	1
Sirup..... gallons per acre..	72	53	56	60	66	50	61
Average yield..... percent of potential..	38	20			39	72	72
Nitrogen:							
Total use..... short tons..	1,098	80	100	132	682	79	2,171
Average use..... pounds per acre..	45	6	5	8	18	.02	5
Planted acreage fertilized with N..... percent..	80	80	60	65	99	1	3
Change in application rate, percent:							
+200.....	+30	+57	+19	+26		+0.04	+0.6
+100.....	+23	+31	+10	+14	+5	.03	.4
+50.....	+14	+17	+4	+7	+4	.014	.2
+25.....	+9	+8	+3	+4	+2	.004	.1
+10.....	+4	+3	+8	+2	.8	0	.05
0, average use.....	0	0	0	0	0	0	0
-10.....	-3	-3	-.9	-2	-1	0	-0.05
-25.....	-9	-8	-3	-4	-4	0	-1
-50.....	-24	-15	-6	-9	-8	-.002	-.3
-100, no application.....	-63	-31	-10	-18	-19	-.004	-.8
Phosphoric oxide:							
Total use..... short tons..	627	200	200	396	693	395	2,511
Average use..... pounds per acre..	26	16	10	23	18	.1	6
Planted acreage fertilized with P ₂ O ₅ percent..	80	80	60	65	99	1	3
Change in application rate, percent:							
+200.....	+27	+5	+4	+14	+3	+0.08	+0.4
+100.....	+24	+4	+4	+16	+3	.057	.3
+50.....	+14	+3	+2	+12	+2	.038	.2
+25.....	+8	+2	+1	+8	+1	.019	.1
+10.....	+4	+1	.5	+4	.5	.0038	.05
0, average use.....	0	0	0	0	0	0	0
-10.....	-3	-1	-.6	-2	-6	-.019	-.06
-25.....	-11	-3	-2	-5	-2	-.038	-.2
-50.....	-24	-6	2	-13	-3	-.057	-.3
-100, no application.....	-53	-12	-6	-30	-8	-.08	-.7
Potash:							
Total use..... short tons..	470	120	150	264	385	39	1,428
Average use..... pounds per acre..	19	10	7	16	10	.01	3
Planted acreage fertilized with K ₂ O..... percent..	80	80	60	65	99	1	3
Change in application rate, percent:							
+200.....	+21	+6	-5	+4	+0.036	+0.2	
+100.....	+11	+13	+4	-.7	+2	.024	.2
+50.....	+7	+7	+2	+1	.9	.016	.1
+25.....	+3	+4	+1	+2	.5	.008	.06

Predicted percent change in yield with change in N fertilizer rate
+200.....
+100.....
+50.....
+25.....
+10.....
0, average use.....
-10.....
-25.....
-50.....
-100, no application.....
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate
+200.....
+100.....
+50.....
+25.....
+10.....
0, average use.....
-10.....
-25.....
-50.....
-100, no application.....
Predicted percent change in yield with change in K ₂ O fertilizer rate
+200.....
+100.....
+50.....
+25.....
+10.....
0, average use.....
-10.....
-25.....
-50.....
-100, no application.....

Predicted percent change in yield with change in K ₂ O fertilizer rate
+200.....
+100.....
+50.....
+25.....
+10.....
0, average use.....
-10.....
-25.....
-50.....
-100, no application.....

TABLE 16.—*Wheat in the southern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Miss.	Ark.	Okla.	Tex.	Weighted average for States reporting
Nitrogen rate:												
160.												
120.												
80.	36							33				36
40.	29	37	24	30	28	31	27	26	36	32	27	30
20.	23	28	17	25	25	26	19	21	29	27	23	25
10.	19	21	13	21	22	22	15	16	20	23	21	19
0.	15	14	7	17	17	17	11	11	12	15	18	16
Average use (cf. table 17).	20	25	18	19	18	21	19	28	29	15	18	17
Phosphoric oxide rate:												
160.						28						
120.						28						
80.	28					28						28
40.	24	24	20	30	18	26	33		41	35	24	29
20.	17	19	17	30	12	22	31		35	25	24	22
10.	13	13	15	28	8	19	28		27	20	23	20
0.	9	10	12	27	3	15	24		16	15	21	17
Average use (cf. table 17).	20	18	16	29	15	22	31		41	16	21	19
Potash rate:												
160.						29						
120.						28						
80.	29					28						29
40.	27	15	23	33	27	26	34		41			24
20.	23	13	21	33	26	28	33		38			23
10.	21	12	18	31	24	27	31		33			21
0.	19	11	15	29	20	24	29		20			19
Average use (cf. table 17).	23	13	20	31	24	27	31		38			22

TABLE 17.—Wheat in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N , P_2O_5 , and K_2O , 1950 basis.

Application rate of 17, 125, and 112, 1935-1936												
Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Miss.	Ark.	Okla.	Tex.	Weighted average for States reporting
Acreages and yields:												
Planted acreage.....1,000 acres.....	451	471	161	172	420	294	13	11	19	6,117	6,235	14,364
Harvested acreage.....do.....	425	375	156	152	260	270	12	6	19	4,846	2,839	9,360
Total production.....1,000 bushels.....	7,862	5,438	2,184	1,900	3,900	3,375	180	126	285	43,614	22,712	91,576
Average yield.....bushels per acre.....	18	14	14	12	15	12	15	21	15	9	8	10
Do.....percent of potential.....	50	38	58	36	52	39	44	75	36	26	30	31
Nitrogen:												
Total use.....short tons.....	2,842	3,393	1,759	552	555	1,050	130	300	190	650	1,029	12,450
Average use.....pounds per acre.....	13	14	22	6	3	7	20	54	20	.2	.3	2
Planted acreage fertilized with N.....percent.....	90	80	95	80	26	75	98	95	100	11	1	15
Predicted percent change in yield with change in N fertilizer rate												
Change in application rate, percent:												
+200.....	+41	+51	+63	+26	+10	+16	+63	-	+39	+3	+2	+7
+100.....	+23	+24	+37	+15	+5	+8	+39	-	+27	+3	+1	+4
+50.....	+12	+15	+19	+10	+3	+2	+22	-	+15	+1	+5	+2
+25.....	+6	+7	+10	+4	+2	+2	+11	+6	+9	+7	+2	+1
+10.....	+2	+5	+4	+2	+1	+.5	+4	+.9	+6	+3	+1	+5
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-4	-7	-5	-3	-1	-6	-2	-4	-6	-.3	-0	-.7
-25.....	-6	-9	-14	-5	-3	-8	-8	-8	-17	-.7	-.6	-2
-50.....	-13	-17	-29	-7	-4	-16	-22	-14	-31	-1	-1	-3
-100, no application.....	-26	-46	-59	-14	-8	-23	-40	-62	-57	-3	-3	-6
Phosphoric oxide:												
Total use.....short tons.....	6,090	4,524	1,377	1,104	6,565	2,550	130	-	380	7,150	623	30,493
Average use.....pounds per acre.....	27	19	17	13	31	17	20	-	40	2	.2	4
Planted acreage fertilized with P ₂ O ₅.....percent.....	90	80	95	80	54	75	98	-	100	11	1	16
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate												
Change in application rate, percent:												
+200.....	+42	+41	+31	+3	+86	+24	+8	-	-	+13	+2	+12
+100.....	+33	+28	+22	+4	+65	+16	+6	-	-	+7	+1	+8
+50.....	+20	+17	+10	+3	+37	+8	+5	-	+3	+3	+9	+4
+25.....	+10	+9	+6	+2	+17	+3	+2	-	+3	+.9	+4	+2
+10.....	+4	+4	+4	+.7	+7	+.9	+1	-	+.6	+3	+1	+7
0, average use.....	0	0	0	0	0	0	0	-	0	0	0	0
-10.....	-5	-5	-2	-7	-7	-1	-1	-	-.8	-2	-1	-1
-25.....	-14	-13	-6	-1	-19	-8	-4	-	-5	-3	-3	-3
-50.....	-26	-24	-11	-2	-33	-15	-9	-	-14	-4	-6	-5
-100, no application.....	-56	-45	-30	-7	-84	-31	-20	-	-59	-8	-1	-11
Potash:												
Total use.....short tons.....	4,060	2,545	1,377	833	1,764	1,500	78	-	190	-	-	12,347
Average use.....pounds per acre.....	18	11	17	10	8	10	12	-	20	-	-	12
Planted acreage fertilized with K ₂ O.....percent.....	90	80	95	80	28	75	98	-	100	-	-	72

FERTILIZER USE AND CROP YIELDS

TABLE 18.—*Rye in the southern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Va.	S. C.	Ga.	Fla.	Ky.	Tenn.	Tex.	Weighted average for States reporting
Nitrogen rate:								
160								
120								
80	43							43
40	31	48	31	31	30	34		33
20	24	36	26	26	26	28		27
10	20	29	22	22	22	23		22
0	16	20	18	18	18	18		18
Average use (cf. table 18)	17	22	20	19	19	20		19
Phosphoric oxide rate:								
160								
120								
80	29							30
40	25	30	31	31	18	28		25
20	19	26	31	31	12	23		20
10	14	23	30	30	8	20		16
0	9	20	28	28	2	17		12
Average use (cf. table 19)	12	21	30	29	16	20		18
Potash rate:								
160								
120								
80	31							23
40	28	23	36	35	30	28		29
20	25	21	35	35	29	31		28
10	22	19	33	33	27	29		26
0	20	17	30	30	25	26		24
Average use (cf. table 19)	21	18	32	31	27	28		25

TABLE 19.—*Rye in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Va.	S. C.	Ga.	Fla.	Ky.	Tenn.	Tex.	Weighted average for States reporting
Acreages and yields:								
Planted acreage..... 1,000 acres	136	32	20	10	136	140	32	506
Harvested acreage..... do	26	9	4		21	22	28	110
Total production..... 1,000 bushels	390	90	44		242	220	196	1,182
Average yield..... bushels per acre	15	10	11		12	10	7	11
Do..... percent of potential	35	21	30		40	29	28	32
Nitrogen:								
Total use..... short tons	135	38	48	8	180	243		652
Average use..... pounds per acre	2	2	5	2	3	4		5
Planted acreage fertilized with N..... percent	20	30	60	10	26	74		40
Predicted percent change in yield with change in N fertilizer rate								
Change in application rate, percent:								
+200	+8	+19	+23	+7	+10	+18		+13
+100	+4	+10	+13	+3	+6	+9		+7
+50	+2	+5	+7	+3	+2	+4		+3
+25	+1	+2	+4	+1	+1	+2		+1
+10	.5	+1	+2	.4	.5	+5		.6
0, average use	0	0	0	0	0	0		0
-10	-1	-1	-1	-.4	-1	-1		-1
-25	-2	-3	-4	-2	-3	-2		-2
-50	-4	-5	-7	-5	-5	-5		-5
-100, no application	-6	-9	-9	-6	-6	-9		-7
Phosphoric oxide:								
Total use..... short tons	405	53	96	8	2,126	729	160	3,577
Average use..... pounds per acre	6	3	10	2	31	10	10	14
Planted acreage fertilized with P ₂ O ₅ percent	20	30	60	10	54	74	60	48
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate								
Change in application rate, percent:								
+200	+41	+8	+4	+2	+84	+33	+6	+44
+100	+21	+5	+3	.9	+65	+16	+6	+28
+50	+10	+2	+2	+6	+35	+9	+3	+15
+25	+7	+1	.6	.3	+17	+5	+.9	+8
+10	+2	.5	.3	.1	+6	+2	+.3	+3
0, average use	0	0	0	0	0	0	0	0
-10	-3	-1	-.7	-.1	-7	-2	-.4	-3
-25	-7	-2	-2	-.3	-17	-4	-1	-8
-50	-12	-3	-4	-.7	-37	-8	-3	-16
-100, no application	-27	-5	-8	-.9	-84	-18	-7	-36
Potash:								
Total use..... short tons	270	53	72	6	572	486		1,459
Average use..... pounds per acre	4	3	7	1	8	7		6
Planted acreage fertilized with K ₂ O..... percent	20	30	60	10	28	74		40
Predicted percent change in yield with change in K ₂ O fertilizer rate								
Change in application rate, percent:								
+200	+8	+9	+7	+2	+10	+10		+9
+100	+4	+5	+5	.9	+6	+6		+5
+50	+2	+2	+3	.7	+3	+3		+3
+25	+1	+1	+2	.5	+2	+1		+1
+10	.2	.3	.6	.3	.7	.5		.4
0, average use	0	0	0	0	0	0		0
-10	-.4	-.6	-.4	-.3	-.4	-.6		-1
-25	-1	-1	-2	-.7	-1	-2		-1
-50	-2	-2	-2	-.2	-3	-3		-3

TABLE 20.—*Barley in the southern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Ark.	Tex.	Weighted average for States reporting
Nitrogen rate:										
160										
120										
80	46									46
40	36	46	30	37	35	40	33	46	34	36
20	29	35	21	31	30	32	24	34	29	30
10	24	27	16	27	27	27	20	25	26	26
0	19	18	10	21	21	22	14	14	23	21
Average use (cf. table 21)	27	31	26	26	23	27	24	29	23	25
Phosphoric oxide rate:										
160										
120										
80	35									35
40	29	30	35	37	23	33	41	51	30	30
20	23	23	35	37	14	28	38	44	30	28
10	17	18	34	35	9	24	35	33	28	22
0	10	12	32	33	3	20	30	22	26	17
Average use (cf. table 21)	27	23	35	36	19	28	38	46	26	26
Potash rate:										
160										
120										
80	36									36
40	32		29	41	35	33	43	51		33
20	29		24	40	33	35	41	48		32
10	26		21	39	31	33	38	41		29
0	24		19	36	28	30	34	45		27
Average use (cf. table 21)	29		23	39	28	34	38	41		30

TABLE 21.—*Barley in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Ark.	Tex.	Weighted average for States reporting
Acreages and yields:										
Planted acreage..... 1,000 acres.....	103	43	26	6	89	87	3	3	172	532
Harvested acreage..... do.....	95	37	22	5	63	66	2	4	133	427
Total production..... 1,000 bushels.....	2,898	888	440	110	1,480	1,221	40	84	1,729	8,890
Average yield..... bushels per acre.....	30	24	20	22	23	18	20	21	13	21
Do..... percent of potential.....	65	52	57	54	66	45	46	41	38	52
Nitrogen:										
Total use..... short tons.....	882	306	370	24	118	350	30	23	28	2,131
Average use..... pounds per acre.....	17	14	28	8	3	8	20	15	.3	8
Planted acreage fertilized with N..... percent.....	95	80	95	100	26	95	98	50	1	52
Change in application rate, percent:										
+200	+46	+55		+28	+11	+27	+60	+64	+2	+22
+100	+25	+30		+14	+6	+14	+36	+41	+2	+12
+50	+14	+15	+18	+8	+3	+6	+19	+24	+1	+7
+25	+6	+7	+8	+4	+2	+3	+8	+14	+8	+3
+10	+2	+2	+2	+1	+.6	+1	+2	+5	+4	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-2	-6	-11	-2	-.6	-2	-3	-4	-.5	-2
-25	-6	-12	-14	-5	-1	-4	-9	-12	-.9	-4
-50	-14	-20	-30	-9	-3	-9	-20	-22	-1	-8
-100, no application.....	-31	-42	-61	-16	-7	-19	-42	-52	-2	-18
Phosphoric oxide:										
Total use..... short tons.....	1,764	408	247	48	1,391	850	30	38	17	4,793
Average use..... pounds per acre.....	34	19	19	16	31	20	20	25	.2	18
Planted acreage fertilized with P ₂ O ₅ percent.....	95	80	95	100	54	95	98	50	1	56
Change in application rate, percent:										
+200	+27	+40	+0.3	+0.5	+80	+19	+11	+10	+2	+27
+100	+26	+27	+0.3	+.9	+61	+18	+8	+10	+2	+21
+50	+16	+16	+.3	+2	+35	+12	+5	+8	+8	+13
+25	+8	+8	+.3	+1	+18	+5	+3	+6	+4	+6
+10	+3	+3	+.3	+.9	+7	+2	+1	+3	+2	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-4	-5	-.6	-.9	-7	-2	-2	-4	-.2	0
-25	-11	-12	-1	-2	-17	-5	-4	-11	-.4	-7
-50	-25	-22	-2	-3	-37	-12	-9	-24	-.8	-15
-100, no application.....	-62	-47	-7	-8	-83	-27	-20	-55	-2	-36
Potash:										
Total use..... short tons.....	1,176	247	36	37	500	18	15			2,029
Average use..... pounds per acre.....	23	19	12	8	11	12	10			13
Planted acreage fertilized with K ₂ O..... percent.....	95	95	100	28	95	98	50			76
Change in application rate, percent:										
+200	+22			+6	+2	-0.6	+11	+21		+9
+100	+14		+22	+5	+2	+4	+7	+15		+8
+50	+8		+12	+3	+1	+4	+5	+10		+5
+25	+6		+8	+2	+.7	+2	+3	+5		+3
+10	+2		+2	+.4	+.4	+.6	+1	+2		+1
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-2		-2	-.4	-.2	-.6	-1	-3		-1
-25	-5		-3	-2	-.4	-.2	-3	-8		-3
-50	-10		-9	-4	-.5	-.5	-5	-19		-6
-100, no application.....	-12		-12	-6	-.5	-.5	-19			

Predicted percent change in yield with change in N fertilizer rate

	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Ark.	Tex.	Weighted average for States reporting
+200	+55			+28	+11	+27	+60	+64	+2	+22
+100	+30			+14	+6	+14	+36	+41	+2	+12
+50	+15	+15	+18	+8	+3	+6	+19	+24	+1	+7
+25	+7	+7	+8	+4	+2	+3	+8	+14	+8	+3
+10	+2	+2	+2	+1	+.6	+1	+2	+5	+4	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-2	-6	-11	-2	-.6	-2	-3	-4	-.5	-2
-25	-6	-12	-14	-5	-1	-4	-9	-12	-.9	-4
-50	-14	-20	-30	-9	-3	-9	-20	-22	-1	-8
-100, no application.....	-31	-42	-61	-16	-7	-19	-42	-52	-2	-18

Predicted percent change in yield with change in P₂O₅ fertilizer rate

	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Ark.	Tex.	Weighted average for States reporting
+200	+46			+28	+11	+27	+60	+64	+2	+22
+100	+25			+14	+6	+14	+36	+41	+2	+12
+50	+14			+8	+3	+6	+19	+24	+1	+7
+25	+6			+4	+2	+3	+8	+14	+8	+3
+10	+2			+1	+.6	+1	+2	+5	+4	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-2			-2	-.4	-.2	-.6	-1	0	0
-25	-5			-3	-2	-.4	-.2	-3	-8	-3
-50	-10			-9	-4	-.5	-.5	-5	-19	-6
-100, no application.....	-12			-12	-6	-.5	-.5	-19		

Predicted percent change in yield with change in K₂O fertilizer rate

	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Ark.	Tex.	Weighted average for States reporting
+200	+55			+28	+11	+27	+60	+64	+2	+22
+100	+25			+14	+6	+14	+36	+41	+2	+12
+50	+14			+8	+3	+6	+19	+24	+1	+7
+25	+6			+4	+2	+3	+8	+14	+8	+3
+10	+2			+1	+.6	+1	+2	+5	+4	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-2			-2	-.4	-.2	-.6	-1	0	0
-25	-5			-3	-2	-.4	-.2	-3	-8	-3
-50	-10			-9	-4	-.5	-.5	-5	-19	-6
-100, no application.....	-12			-12	-6	-.5	-.5	-19		

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TABLE 22.—Oats in the southern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okla.	Tex.	Weighted average for States reporting
Nitrogen rate:														
160														
120														
80		55												58
40	41	70	47	55	55	52	59	61	48	68	48	59	51	54
20	35	52	35	46	46	46	46	36	39	52	35	50	43	44
10	31	40	26	40	40	40	41	28	32	38	28	42	39	37
0	29	27	16	32	31	32	32	22	23	22	20	28	34	28
Average use (cf. table 23)	34	46	35	37	36	35	37	36	42	44	36	28	35	36
Phosphoric oxide rate:														
160														
120														
80		52												52
40	44		60	55	55	35	49	62		76	64	48	45	51
20	33		56	55	55	22	41	57		65	52	35	44	42
10	25		54	53	52	14	35	52		50	44	29	42	38
0	16		50	49	50	4	30	46		31	33	22	39	36
Average use (cf. table 23)	41		54	54	52	29	38	57		69	36	24	40	42
Potash rate:														
160														
120														
80		54												28
40	49		56	61	61	38	49	64		77	50	26	43	47
20	43		45	60	60	36	52	61		72	46	26	41	44
10	39		38	57	58	35	50	57		61	44	26	40	42
0	36		32	53	53	32	44	51		38	38	26	38	38
Average use (cf. table 23)	44		38	57	55	34	48	57		72	40	26	38	41

TABLE 23.—Oats in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okla.	Tex.	Weighted average for States reporting
Acreages and yields:														
Planted acreage..... 1,000 acres.....	196	515	758	815	123	187	325	263	302	221	71	1,146	1,805	6,727
Harvested acreage..... "do.....	402	678	907	16	118	239	158	249	212	71	838	1,386	5,124	
Total production..... 1,000 bushels.....	5,200	11,859	18,984	16,119	288	2,832	5,975	4,108	7,719	6,254	1,952	14,665	27,027	122,982
Average yield..... bushels per acre.....	32	30	28	27	18	24	25	26	31	30	27	18	20	24
Do..... percent of potential.....	58	43	47	44	30	45	42	41	64	39	42	30	39	42
Nitrogen:														
Total use..... short tons.....	1,767	3,708	7,163	2,608	295	247	893	2,620	4,756	1,768	750	171	594	27,340
Average use..... pounds per acre.....	18	14	20	6	5	3	6	20	29	14	21	.3	.7	8
Planted acreage fertilized with N..... percent.....	95	80	90	80	30	26	75	98	80	80	95	10	2	47
Predicted percent change in yield with change in N fertilizer rate														
Change in application rate, percent:														
+200.....	+36	+56	-34	+23	+18	+10	+22	+60	-	+57	+56	+3	+2	+19
+100.....	+18	+31	+34	+13	+10	+6	+11	+38	+23	+40	+37	+2	+2	+14
+50.....	+9	+15	+17	+6	+4	+2	+3	+20	+15	+26	+22	+2	+1	+7
+25.....	+3	+10	+7	+4	+4	+1	+1	+10	+9	+13	+11	+1	+.5	+4
+10.....	+1	+4	+2	+2	+1	+.5	+5	+4	+3	+4	+3	+.3	+.2	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-2	-3	-8	-2	-2	-6	-4	-3	-4	-4	-4	-.4	-.6	-2
-25.....	-4	-10	-15	-4	-4	-2	-6	-8	-9	-12	-9	-1	-.9	-5
-50.....	-10	-10	-25	-7	-5	-3	-9	-18	-18	-26	-19	-2	-1	-8
-100, no application.....	-16	-31	-54	-14	-13	-6	-14	-40	-46	-52	-52	-3	-3	-19
Phosphoric oxide:														
Total use..... short tons.....	3,348	.....	3,752	5,216	295	2,923	2,167	2,630	.....	2,652	100	1,368	360	24,811
Average use..... pounds per acre.....	34	.....	10	13	5	31	13	20	.....	24	3	2	.4	8
Planted acreage fertilized with P ₂ O ₅ percent.....	95	.....	90	80	30	54	75	98	.....	80	95	10	2	43
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate														
Change in application rate, percent:														
+200.....	+28	.....	+8	+2	+5	+78	+30	+10	.....	+13	+15	+13	+2	+11
+100.....	+26	.....	+4	+3	+2	+59	+15	+8	.....	+12	+8	+6	+1	+7
+50.....	+17	.....	+3	+2	+1	+33	+8	+6	.....	+9	+4	+3	+1	+4
+25.....	+9	.....	+2	+.9	+.6	+16	+5	+4	.....	+6	+1	+2	+.5	+2
+10.....	+4	.....	+1	+.3	+.4	+5	+7	+2	.....	+2	+5	.8	+.2	+.9
0, average use.....	0	.....	0	0	0	0	0	0	.....	0	0	0	0	0
-10.....	-4	.....	-2	-8	-.5	-6	-1	-2	.....	-4	-.6	-.8	-.3	-1
-25.....	-15	.....	-2	-2	-.7	-18	-8	-4	.....	-11	-2	-2	-.6	-3
-50.....	-26	.....	-3	-3	-1	-40	-12	-9	.....	-26	-4	-4	-.8	-6
-100, no application.....	-62	.....	-7	-8	-2	-87	-21	-20	.....	-55	-8	-6	-1	-12
Potash:														
Total use..... short tons.....	2,232	.....	3,752	3,912	222	785	1,275	1,578	.....	2,210	100	285	18	16,369
Average use..... pounds per acre.....	23	.....	10	10	4	8	8	12	.....	20	3	.5	.02	6
Planted acreage fertilized with K ₂ O..... percent.....	95	.....	90	80	30	28	75	98	.....	80	95	10	2	42
Predicted percent change in yield with change in K ₂ O fertilizer rate														
Change in application rate, percent:														
+200.....	+22	.....	+30	+8	+5	+7	+9	+11	.....	+7	+7	+0.4	+1	+8
+100.....	+13	.....	+17	+5	+3	+5	+6	+7	.....	+8	+3	+2	+1	+5
+50.....	+7	.....	+10	+4	+1	+3	+4	+4	.....	+5	+1	+2	+.7	+3
+25.....	+4	.....	+4	+3	+.6	+2	+3	+3	.....	+3	+.9	+1	+.5	+2
+10.....	+1	.....	+2	+2	+.3	+2	+.7	+2	.....	+2	+4	+0.08	+.2	.7
0, average use.....	0	.....	0	0	0	0	0	0	.....	0	0	0	0	0

TABLE 24.—*Soybeans in the southern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Weighted average for States reporting
Nitrogen rate:												
160												
120												
80												
40	32	32	32	23	27	28	31					30
20	32	32	32	22	27	28	31					30
10	32	32	32	21	26	28	31					30
0	30	30	30	20	24	26	29					28
Average use (cf. table 25)	32	32	32	20	27	28	31					30
Phosphoric oxide rate:												
160												
120												
80	32	35	32	32	26	32	32	32	35			33
40	30	30	30	30	22	30	32	30	32	32		31
20	27	28	27	27	19	27	31	27	32	29		29
10	26	26	26	26	18	25	31	26	31	28		28
0	24	24	23	23	15	22	30	23	30	25		26
Average use (cf. table 25)	26	26	26	24	23	24	30	27	31	26		28
Potash rate:												
160												
120												
80	32	32	37	37	27	32	32	37	32			32
40	30	30	30	30	25	31	32	30	32	34		32
20	28	28	28	28	23	30	31	28	32	33		31
10	26	26	26	26	22	29	31	26	32	32		31
0	25	25	24	24	20	28	30	24	31	30		28
Average use (cf. table 25)	27	28	27	25	25	28	30	26	31	30		29

TABLE 25.—*Soybeans in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Average application rate of 17, 12½, and 11½, 1953 basis															
Acreages, yields, and fertilizer use			Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Weighted average for States reporting	
Acreages and yields:															
Planted acreage	.....	1,000 acres	153	403	44	118	8	225	260	190	293	500	121	2,215
Harvested acreage	.....	do	133	301	44	24	.....	108	150	90	282	556	40	1,728
Total production	.....	1,000 bushels	2,527	5,117	528	204	.....	1,890	3,150	1,620	6,768	11,676	720	34,200
Average yield	.....	bushels per acre	19	17	12	8	.....	18	21	18	24	21	18	20
Do	.....	percent of potential	59	48	32	22	.....	56	66	49	75	60	56	59
Nitrogen:															
Total use	.....	short tons	46	100	26	142	96	200	180	.....	.....	.....	.....	790
Average use	.....	pounds per acre	.6	.5	1	2	24	2	1	.....	.....	.....	.....	1
Planted acreage fertilized with N	.....	percent	60	50	60	60	100	18	40	.....	.....	.....	.....	45
Predicted percent change in yield with change in N fertilizer rate															
Change in application rate, percent:															
+200	.....	.....	+0.3	0	0	+2	0	+0.7	0	.....	.....	.....	.....	+0.4
+100	.....	.....	+100	0	0	+2	0	+7	0	.....	.....	.....	.....	+4
+50	.....	.....	+50	0	0	+2	0	+7	0	.....	.....	.....	.....	+4
+25	.....	.....	+25	0	0	+8	0	+7	0	.....	.....	.....	.....	+2
+10	.....	.....	+10	0	0	+2	0	+3	0	.....	.....	.....	.....	+1
0, average use	.....	.....	0	0	0	0	0	0	0	0	0	0	0	0
-10	.....	.....	-10	0	0	0	0	0	0	0	0	0	0	-5
-25	.....	.....	-25	-7	0	-08	0	-1	0	0	0	0	0	-1
-50	.....	.....	-50	-2	0	-2	-8	-2	-4	.....	.....	.....	.....	-3
-100, no application	.....	.....	-100	-8	-8	-3	-1	-4	-2	.....	.....	.....	.....	-6
Phosphoric oxide:															
Total use	.....	short tons	1,150	2,814	317	284	200	984	540	816	470	1,500	214	9,289
Average use	.....	pounds per acre	15	14	14	5	50	9	4	18	3	6	4	8
Planted acreage fertilized with P ₂ O ₅	.....	percent	60	50	60	60	100	35	40	99	16	30	28	41
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate															
Change in application rate, percent:															
+200	+200	+16	+14	+15	+8	+16	+16	+2	+17	+0.8	+10	+4	+10
+100	+100	+9	+8	+9	+4	+17	+8	+2	+10	+4	+5	+3	+5
+50	+50	+5	+6	+5	+2	+10	+5	+1	+6	+2	+3	+2	+3
+25	+25	+2	+2	+3	+1	+4	+3	+8	+3	+1	+2	+1	+2
+10	+10	+1	+2	+3	+1	+2	+1	0	+6	+05	+4	+7	+5
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-10	-8	-1	-1	-5	-3	-1	-1	-9	-1	-4	-4	-6
-25	-25	-2	-2	-2	-2	-8	-2	-2	-2	-3	-2	-8	-2
-50	-50	-8	-5	-5	-3	-16	-3	-9	-6	-7	-3	-1	-3
-100, no application	-100	-10	-10	-11	-5	-35	-7	-2	-13	-2	-5	-2	-6
Potash:															
Total use	.....	short tons	920	3,216	317	213	160	180	360	442	235	450	57	6,550
Average use	.....	pounds per acre	12	16	14	4	40	2	3	10	2	2	.9	6
Planted acreage fertilized with K ₂ O	.....	percent	60	50	60	60	100	18	40	99	16	30	28	39
Predicted percent change in yield with change in K ₂ O fertilizer rate															
Change in application rate, percent:															
+200	+200	+11	+14	+13	+6	+2	+2	+7	+2	+2	+0.9	+5
+100	+100	+6	+7	+7	+2	+9	+2	+9	+6	+9	+1	+5	+3
+50	+50	+4	+3	+4	+1	+5	+1	+5	+4	+4	+5	+3	+1
+25	+25	+2	+2	+2	+7	+3	+7	+3	+2	+2	+3	+1	+9
+10	+10	+3	+1	+9	+2	+2	+3	+1	+8	+08	+1	+04	+3
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-10	-4	-1	-1	-2	-2	-4	-1	-8	-08	-1	-04	-4
-25	-25	-2	-3	-3	-7	-4	-8	-3	-2	-2	-2	-1	-1
-50	-50	-4	-4	-5	-2	-8	-1	-5	-3	-4	-5	-3	-2

FERTILIZER USE AND CROP YIELDS

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TABLE 26.—Peanuts in the southern region: Estimated average yield (pounds per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Fla.	Ala.	Okla.	Tex.	Weighted average for States reporting
Nitrogen rate:									
160									
120									
80									
40	1,720	1,650	1,320	1,400	1,200		880	886	1,270
20	1,690	1,630	1,290	1,337	1,160		810	843	1,219
10	1,650	1,575	1,215	1,278	1,100		745	760	1,187
0	1,600	1,430	1,100	1,225	1,000		650	659	1,075
Average use (cf. table 27)	1,610	1,430	1,160	1,249	1,013		660	705	1,098
Phosphoric oxide rate:									
160									
120									
80									
40	1,830	1,650	1,290	1,233	1,200	1,355	880	865	1,223
20	1,790	1,610	1,270	1,225	1,100	1,310	800	829	1,187
10	1,700	1,540	1,200	1,215	1,000	1,250	730	759	1,136
0	1,600	1,430	1,100	1,174	900	1,180	645	645	1,055
Average use (cf. table 27)	1,830	1,465	1,280	1,223	980	1,330	725	802	1,166
Potash rate:									
160									
120			1,350						1,350
80			1,440						1,389
40	1,710	1,480	1,225	1,415	1,200	1,320	860	875	1,262
20	1,680	1,475	1,295	1,360	1,150	1,180	790	798	1,198
10	1,640	1,465	1,150	1,326	1,100	1,140	725	735	1,155
0	1,600	1,440	1,100	1,280	1,000	1,050	648	660	1,091
Average use (cf. table 27)	1,710	1,450	1,220	1,324	1,040	1,160	664	675	1,139

TABLE 27.—Peanuts in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acres, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Fla.	Ala.	Okla.	Tex.	Weighted average for States reporting
Acreages and yields:									
Planted acreage..... 1,000 acres	155	253	21	1,014	262	381	204	622	2,812
Harvested acreage..... do	146	231	20	735	72	332	216	490	2,242
Total production..... 1,000 pounds	224,110	246,015	15,800	679,875	59,040	325,360	125,280	323,400	1,998,880
Average yield..... pounds per acre	1,535	1,065	790	925	820	980	580	660	892
Do..... percent of potential	84	64	60	65	68	72	66	75	70
Nitrogen:									
Total use..... short tons	310	9	57	3,020	150	-----	122	678	4,346
Average use..... pounds per acre	4	.07	5	6	1	-----	1	3	4
Planted acreage fertilized with N..... percent	80	12	90	75	25	-----	60	65	60
Change in application rate, percent:									
+200.....	+2	+0.2	+8	+6	+2	+	+3	+6	+4
+100.....	+1	+4	+3	+3	+1	+	+1	+3	+2
+50.....	.6	.07	+3	+2	.5	+	.6	+1	+1
+25.....	.3	.04	+2	.9	.3	+	.3	+7	+6
+10.....	.1	.02	+1	.1	.1	+	.1	+2	+1
0, average use.....	0	0	0	0	0	0	0	0	0
-10.....	-.1	0	-.9	-.3	-.1	0	-.1	-.8	-.3
-25.....	-.3	0	-2	-.7	-.3	0	-.3	-2	-.8
-50.....	-.9	0	-4	-2	-.5	0	-.7	-4	-2
-100, no application.....	-2	0	-6	-2	-1	0	-1	-7	-3
Phosphoric oxide:									
Total use..... short tons	3,100	180	340	6,080	750	4,572	976	4,068	20,066
Average use..... pounds per acre	40	1	32	12	6	24	10	16	14
Planted acreage fertilized with P ₂ O ₅ percent	80	12	90	75	25	98	60	65	65
Change in application rate, percent:									
+200.....	+1	-.6	+2	+11	-----	+14	+8	+5	+5
+100.....	+.3	.7	+0.6	+1	+6	+2	+8	+8	+3
+50.....	.3	.4	+4	.9	+3	+2	+4	+4	+2
+25.....	.2	.2	+3	.5	+2	+1	+2	+3	+1
+10.....	.05	.06	.2	.3	+1	.8	.6	.1	.5
0, average use.....	0	0	0	0	0	0	0	0	0
-10.....	-.1	-.07	-.4	-.3	-.2	-.8	-.7	-1	-.5
-25.....	-.2	-.4	-.8	-.7	-1	-2	-2	-4	-2
-50.....	-2	-2	-4	-2	-3	-5	-5	-8	-4
-100, no application.....	-13	-2	-13	-4	-6	-14	-10	-19	-9
Potash:									
Total use..... short tons	3,100	450	340	4,560	500	2,476	305	847	12,578
Average use..... pounds per acre	40	4	32	9	4	13	3	3	19
Planted acreage fertilized with K ₂ O..... percent	80	12	90	75	25	98	60	65	65
Change in application rate, percent:									
+200.....	+1	-.6	+0.08	+4	+6	+14	+8	+10	+7
+100.....	+.3	.2	.08	+3	+4	+7	+4	+5	+4
+50.....	.3	.2	.3	.7	+2	+6	+2	+4	+2
+25.....	.2	.1	.3	.5	+1	+3	+9	+2	+1
+10.....	.1	.06	.08	.3	.8	.9	+4	+7	+0
0, average use.....	0	0	0	0	0	0	0	0	0
-10.....	-.1	-.1	-.4	-.4	-.4	-.9	-.4	-.8	-.5
-25.....	-.2	-.4	-2	-.4	-1	-2	-.8	-2	-1

TABLE 28.—*Lint cotton in the southern region: Estimated average yield (pounds per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okl.	Tex.	Weighted average for States reporting
Nitrogen rate:														
160	478	640												634
120	500	662												655
80	490	648	466				560	560						566
40	427	569	416	402	233	542	542	455	507	542	536	376	681	562
20	376	500	369	366	206	491	491	372	441	462	455	345	648	512
10	350	464	324	341	184	455	455	315	394	410	396	324	617	474
0	318	424	287	318	161	410	408	234	343	350	315	285	581	428
Average use (cf. table 29)	427	504	416	385	219	525	490	420	497	422	434	287	588	493
Phosphoric oxide rate:														
160	488	553												560
120	600	574	455											502
80	498	567	425			537	540	472						489
40	460	525	350	333	205	508	506	460	455	559	399	312	665	531
20	429	500	304	332	199	480	476	438	441	543	350	301	647	511
10	411	480	278	328	192	455	455	408	424	534	315	285	629	493
0	400	469	250	317	175	430	429	357	410	525	280	261	609	472
Average use (cf. table 29)	494	546	371	332	201	508	477	464	434	528	308	264	611	497
Potash rate:														
160														
120	494	588	504											536
80	500	598	474											522
40	475	567	429	339	231	472	474	523	468	544	374	360	637	531
20	454	539	385	324	219	440	440	497	461	490	332	348	629	512
10	438	525	346	310	200	420	420	464	448	453	304	332	614	491
0	426	508	289	301	182	385	385	396	433	385	280	303	583	456
Average use (cf. table 29)	486	560	404	332	227	455	441	497	448	444	292	308	585	485

TABLE 29.—*Lint cotton in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

TABLE 30.—Tobacco in the southern region: Estimated average yield (pounds per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Weighted average for States reporting
Nitrogen rate:								
160						1,822		1,822
120						1,748	1,800	1,566
80						1,615	1,800	1,576
40	1,050	1,475	1,400	1,168	1,170	1,436	1,726	1,418
20	930	1,320	1,285	1,066	1,068	1,325	1,648	1,288
10	830	1,220	1,150	995	1,000	1,262	1,574	1,200
0	700	1,100	990	900	900	1,200	1,498	1,095
Average use (cf. table 31)	930	1,475	1,400	1,168	1,210	1,426	1,680	1,403
Phosphoric oxide rate:								
160								1,430
120								1,542
80								1,459
40	1,050	1,425	1,350	1,142	1,139	1,660	1,800	1,388
20	940	1,410	1,340	1,078	1,075	1,476	1,748	1,291
10	850	1,330	1,280	775	950	1,275	1,669	1,220
0	715	1,170	1,190	610	600	1,160	1,625	1,075
Average use (cf. table 31)	1,140	1,430	1,340	1,142	1,145	1,520	1,800	1,424
Potash rate:								
160								1,800
120								1,798
80	1,040	1,400	1,450	1,265	1,263	1,770	1,775	1,482
40	1,040	1,390	1,420	1,250	1,240	1,660	1,724	1,446
20	990	1,325	1,340	1,128	1,127	1,475	1,724	1,348
10	920	1,245	1,250	1,001	1,000	1,350	1,660	1,254
0	870	1,185	1,200	928	938	1,275	1,630	1,193
Average use (cf. table 31)	800	1,100	1,125	855	850	1,200	1,576	1,116
	1,000	1,395	1,430	1,210	1,259	1,400	1,750	1,377

TABLE 31.—Tobacco in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Weighted average for States reporting
Acreages and yields:								
Planted acreage.....1,000 acres.....	119	654	113	93	22	360	101	1,462
Harvested acreage.....do.....	119	651	114	93	22	322	104	1,425
Total production.....1,000 pounds.....	165,496	875,990	150,480	102,120	23,268	361,655	132,105	1,811,114
Average yield.....pounds per acre.....	1,393	1,347	1,320	1,096	1,048	1,122	1,270	1,271
Do.....percent of potential.....	120	89	91	87	83	62	70	84
Nitrogen:								
Total use.....short tons.....	1,160	12,970	2,316	1,864	663	7,056	1,344	27,373
Average use.....pounds per acre.....	20	40	41	40	60	39	27	37
Planted acreage fertilized with N.....percent.....	98	100	100	100	100	98	98	99
Predicted percent change in yield with change in [N fertilizer rate								
+200	+18	+3	+2	+2		+21	+8	+10
+100	+14	+3	+2	+2		+12	+6	+6
+50	+8	+4	+3	+3		+6	+4	+5
+25	+4	+3	+2	+2	-1	+3	+2	+3
+10	+2	+1	+1.7	+0.8	+0.9	+1	+1	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	-2	-1	-2	-3	-0.9	-2	-7	-2
-25	-5	-4	-4	-4	-2	-4	-2	-4
-50	-11	-10	-9	-9	-7	-7	-4	-9
-100, no application.....	-23	-25	-29	-22	-26	-16	-21	-22
Phosphoric oxide:								
Total use.....short tons.....	4,176	37,308	6,554	3,728	1,105	8,820	4,032	65,723
Average use.....pounds per acre.....	70	114	116	80	100	49	80	90
Planted acreage fertilized with P ₂ O ₅.....percent.....	98	100	100	100	100	98	98	99
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate								
+200	+3			+0.4		+14	+0.5	+8
+100	+3			+0.4	+1	+8	0	+5
+50	+2	0		+0.4	+0.6	+3	0	+1
+25	+8	0	0	+0.2	+0.2	+2	0	+0.6
+10	0	0	0	0	0	0	0	0
0, average use.....	-1	0	0	-0.5	-0.3	-1	-0.6	-0.4
-10	-4	-1	0	-1	-0.8	-4	-1	-2
-25	-10	-7	-2	-6	-3	-13	-3	-5
-50	-37	-17	-13	-46	-46	-33	-14	-24
Potash:								
Total use.....short tons.....	2,610	27,543	5,254	2,796	995	5,292	2,688	47,178
Average use.....pounds per acre.....	44	84	93	60	90	30	53	64
Planted acreage fertilized with K ₂ O.....percent.....	98	100	100	100	100	98	98	99
Predicted percent change in yield with change in K ₂ O fertilizer rate								
+200	+4			+4		+21	+4	+14
+100	+4			+4	+1	+12	+3	+8
+50	+3	+0.3		+4	+0.8	+2	+2	+3
+25	+2	+0.3	+0.6	+2	+0.9	+4	+1	+2
+10	+5	+0.3	+0.3	+1	+0.4	+1	+0.8	+0.6
0, average use.....	0	0	0	0	0	0	0	0
-10	-1	-0.4	-0.7	-2	-0.8	-1	-0.3	-0.7
-25	-4	-1	-4	-5	-2	-3	-2	-2

TABLE 32.—Rice, flaxseed, and sugarcane in the southern region: Estimated average yield from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Rice (bags per acre)				Flaxseed (bushels per acre)	Sugarcane (tons per acre)		
	Ark.	La.	Tex.	Weighted average for States reporting		Fla.	La.	Weighted average for States reporting
				Tex.				
Nitrogen rate:								
160						46		46
120						46		46
80						46		46
40						46		46
20						46		46
10						46		46
0						46		46
Average use (cf. table 33)						46		46
Phosphoric oxide rate:						46		46
160						46		46
120						46		46
80						46		46
40						46		46
20						46		46
10						46		46
0						46		46
Average use (cf. table 33)						46		46
Potash rate:						46		46
160						46		46
120						38		38
80						29		29
40						18		20
20						16		18
10						14		18
0						12		18
Average use (cf. table 33)						14		18

TABLE 33.—Rice, flaxseed, and sugarcane in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Rice				Flaxseed	Sugarcane			Weighted average for States reporting
	Ark.	La.	Tex.	Weighted average for States reporting		Tex.	Fla.	La.	
				Tex.					
Acreages and yields:									
Planted acreage..... 1,000 acres	330	557	481	1,368	245	47	306	353	
Harvested acreage..... do	343	545	481	1,369	211	37	276	313	
Total production..... 1,000 bags	7,975	10,491	11,544	30,010	1,266	1,169	5,307	6,476	
Do..... 1,000 bushels									
Do..... 1,000 tons									
Average yield..... bags per acre	23	19	24	22					
Do..... bushels per acre					6				
Do..... tons per acre						32			
Do..... percent of potential	64	54	70	62	23	70	19	21	
Nitrogen:									
Total use..... short tons	1,485	1,500	4,850	7,835	610	118	5,374	5,492	
Average use..... pounds per acre	9	5	20	11	5	5	35	31	
Planted acreage fertilized with N..... percent	30	50	50	39	25	92	95	95	
Change in application rate, percent:									
+200	+14	+15	+18	+16	+47	+21	+42	+30	
+100	+8	+8	+12	+9	+26	+11	+31	+14	
+50	+3	+4	+6	+4	+11	+11	+15	+7	
+25	+2	+1	+3	+2	+6	+7	+7	+2	
+10	.6	.5	.8	.6	+3	+3	+2	+1	
0, average use.....	0	0	0	0	0	0	0	0	
-10	-.8	-.6	-2	-1	-3	-4	-2	-2	
-25	-4	-1	-4	-3	-8	-11	-7	-8	
-50	-5	-5	-7	-6	-17	-14	-16	-16	
-100, no application.....	-8	-9	-14	-10	-31	-21	-29	-28	
Phosphoric oxide:									
Total use..... short tons	495	2,900	1,940	5,335	762	266	762	1,028	
Average use..... pounds per acre	3	10	8	8	6	11	5	6	
Planted acreage fertilized with P ₂ O ₅ percent		50	50	38	25	92	95	95	
Change in application rate, percent:									
+200	+1	+12	+6	+7	+15	+25	+7	+9	
+100	.9	+8	+4	+5	+7	+15	+4	+5	
+50	.5	+4	+2	+2	+4	+8	+3	+4	
+25	.2	+1	+1	+.8	+2	+5	+2	+2	
+10	.07	.7	.4	.4	.9	+2	+1	+1	
0, average use.....	0	0	0	0	0	0	0	0	
-10	-.1	-1	-.3	-.5	-.9	-2	-1	-1	
-25	-.2	-3	-.8	-2	-3	-7	-2	-3	
-50	-.3	-5	-2	-3	-5	-12	-5	-6	
-100, no application.....	-.6	-11	-3	-6	-8	-34	-8	-11	
Potash:									
Total use..... short tons	495	1,900	485	2,880	152	2,005	450	2,455	
Average use..... pounds per acre	3	7	2	4	1	85	3	14	
Planted acreage fertilized with K ₂ O..... percent		50	50	39	25	92	95	95	
Change in application rate, percent:									
+200	+2	+10	+0.4	+5	+1	+90	+4	+15	
+100	.8	+5	+.3	+2	.7	+53	+3	+10	
+50	.4	+3	+.2	+1	.5	+29	+2	+6	
+25	.2	+2	+.1	+.9	.3	+14	+1	+3	
+10	.1	.6	.05	.3	.1	+5	.6	+1	
0, average use.....	0	0	0	0	0	0	0	0	
-10	-.1	-.6	-.05	-.3	-.1	-10	0	0	
-25	-.3	-2	-.1	-.9	-.5	-20	-1	-.7	

FERTILIZER USE AND CROP YIELDS

TABLE 34.—*Potatoes in the southern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Ark.	La.	Tex.	Weighted average for States reporting
Nitrogen rate:												
160					280							280
120	191	290	305	290	180	170	170	173	150	180	160	207
80	180	271	305	271	175	157	157	160	140	164	155	195
40	160	242	270	242	160	138	138	135	120	150	140	173
20	144	228	250	228	142	122	122	116	94	134	124	156
10	132	219	226	219	131	111	111	103	77	124	114	144
0	120	210	208	210	120	100	100	90	50	110	100	131
Average use (cf. table 35)	181	276	315	236	175	137	126	135	126	134	128	183
Phosphoric oxide rate:												
160		360	360	360					176			
120	202	360	360	360	160	164	164	160	152	161	135	310
80	198	348	341	348	150	150	150	136	128	150	130	207
40	183	318	320	318	130	126	126	104	94	128	120	184
20	178	298	300	298	107	107	107	80	72	107	112	166
10	170	288	287	288	95	96	96	62	60	95	106	156
0	164	275	272	275	80	80	80	47	45	80	100	143
Average use (cf. table 35)	200	360	360	339	160	128	139	140	103	128	115	204
Potash rate:												
160		361	368	361				174				311
120	180	360	362	360	156	180	180	172	148	163		228
80	174	348	350	348	149	175	175	165	142	157	114	210
40	158	320	312	320	135	158	158	150	126	143	110	192
20	142	303	300	303	124	140	140	132	111	130	107	177
10	132	292	276	292	118	130	130	122	103	122	104	168
0	120	276	268	276	110	120	120	110	93	110	100	156
Average use (cf. table 35)	172	352	370	327	153	153	153	159	126	143	104	204

TABLE 35.—*Potatoes in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Ark.	La.	Tex.	Weighted average for States reporting
Acreages and yields:												
Planted acreage..... 1,000 acres.....	55	60	17	16	26	31	23	135	23	20	32	338
Harvested acreage..... do.....	55	64	17	16	26	26	22	35	23	21	32	337
Total production..... 1,000 bushels.....	9,405	10,368	1,768	1,248	5,664	2,418	2,200	3,955	1,863	1,386	2,758	42,027
Average yield..... bushels per acre.....	171	162	104	78	217	93	100	113	81	66	86	128
Do..... percent of potential.....	85	45	28	22	120	52	56	64	53	37	54	59
Nitrogen:												
Total use..... short tons.....	2,295	2,700	841	256	1,056	589	280	700	575	200	420	9,912
Average use..... pounds per acre.....	83	90	99	32	80	38	24	40	50	20	26	59
Planted acreage fertilized with N..... percent.....	99	100	99	100	100	95	96	99	100	90	65	95
Change in application rate, percent:												
+200.....			+18		+23	+22	+27	+20	+18	+20	+20	+22
+100.....	+1		+10		+13	+14	+18	+15	+12	+13	+13	+11
+50.....	+7		+5	+3	+7	+8	+11	+9	+7	+8	+8	+7
+25.....	+2	+6	-3	+2	+2	+3	+4	+5	+5	+3	+4	+4
+10.....	+1	.5	+4	0	+8	+1	+1	+2	+2	+1	+2	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-2	-.4	0	-1	-1	-3	-2	-4	-2	-1	-2	-2
-25.....	-4		-4	-3	-3	-6	-5	-7	-8	-4	-5	-5
-50.....	-9		-12	-6	-9	-12	-10	-15	-21	-8	-9	-11
-100, no application.....	-31	-23	-34	-11	-22	-27	-21	-33	-61	-18	-22	-28
Phosphoric oxide:												
Total use..... short tons.....	2,700	3,600	1,683	512	1,584	663	680	1,500	575	400	420	14,317
Average use..... pounds per acre.....	98	120	198	64	120	43	59	86	50	40	26	85
Planted acreage fertilized with P ₂ O ₅ percent.....	99	100	99	100	100	95	96	99	100	90	65	95
Change in application rate, percent:												
+200.....	+0.5		+6		+28			+58	+26	+14		+19
+100.....	+.5		+6		+18	+18	+27	+38	+17	+8		+15
+50.....	+.5	0	+5		+10	+10	+16	+20	+10	+5		+7
+25.....	+.5	0	+3		+5	+2	+8	+11	+5	+3		+8
+10.....	+.5	0	0	+1	0	+2	+1	+3	+5	+2	+8	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-1	-.6	0	-1	-3	-3	-3	-5	-4	-2	-2	-2
-25.....	-2		-2	0	-4	-8	-6	-11	-11	-7	-3	-5
-50.....	-6	-7	-3	-9	-11	-16	-17	-26	-25	-17	-5	-12
-100, no application.....	-19	-23	-24	-18	-50	-37	-42	-66	-56	-38	-12	-33
Potash:												
Total use..... short tons.....	2,025	2,700	1,262	384	1,256	515	400	1,050	460	400	168	10,620
Average use..... pounds per acre.....	74	90	148	48	95	33	35	60	40	40	10	63
Planted acreage fertilized with K ₂ O..... percent.....	99	100	99	100	100	95	96	99	100	90	65	95
Change in application rate, percent:												
+200.....	+2		+10		+18	+17	+9	+17	+14	+5		+10
+100.....	+2		+8		+12	+12	+9	+12	+10	+3		+7
+50.....	+2		+5	+3	+7	+7	+5	+7	+6	+2		+4
+25.....	+2		+2	+3	+5	+4	+3	+4	+3	+1		+3
+10.....	+1	+1	0	+9	+1	+2	+2	+1	+2	+1	+4	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-1	-.6	0	-1	-2	-2	-2	-2	-2	-1	-2	-1
-25.....	-4	-2	-3	-3	-5	-5	-4	-5	-4	-4	-7	-4
-50.....	-9	-8	-7	-6	-10	-13	-11	-11	-12	-9	-1	-9
-100, no application.....	-30	-21	-27	-16	-28	-21	-22	-30	-26	-22	-1	-9
Predicted percent change in yield with change in N fertilizer rate												
+200.....			+18		+23	+22	+27	+20	+18	+20	+20	+22
+100.....	+1		+10		+13	+14	+18	+15	+12	+13	+13	+11
+50.....	+7		+5	+3	+7	+8	+11	+9	+7	+8	+8	+7
+25.....	+2	+6	-3	+2	+3	+4	+5	+5	+3	+4	+4	+4
+10.....	+1	.5	+4	0	+8	+1	+1	+2	+2	+1	+2	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-2	-.4	0	-1	-1	-3	-2	-4	-2	-1	-2	-2
-25.....	-4	-3	-3	-3	-6	-5	-7	-8	-7	-4	-5	-5
-50.....	-9	-8	-7	-6	-10	-13	-11	-11	-12	-9	-1	-9
-100, no application.....	-31	-23	-27	-16	-28	-21	-22	-30	-26	-22	-1	-9
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate												
+200.....			+10		+18	+17	+9	+17	+14	+5		+10
+100.....	+2		+8		+12	+12	+9	+12	+10	+3		+7
+50.....	+2		+5	+3	+7	+7	+5	+7	+6	+2		+4
+25.....	+2		+2	+3	+5	+4	+3	+4	+3	+1		+3
+10.....	+1	+1	0	+9	+1	+2	+2	+1	+2	+1	+4	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-1	-.6	0	-1	-2	-2	-2	-2	-2	-1	-2	-1
-25.....	-4	-2	-3	-3	-5	-5	-4	-5	-4	-4	-7	-4
-50.....	-9	-8	-7	-6	-10	-13	-11	-11	-12	-9	-1	-9
-100, no application.....	-30	-21	-27	-16	-28	-21	-22	-30	-26	-22	-1	-9
Predicted percent change in yield with change in K ₂ O fertilizer rate												
+200.....			+10		+18	+17	+9	+17	+14	+5		+10
+100.....	+2		+8		+12	+12	+9	+12	+10	+3		+7
+50.....	+2		+5	+3	+7	+7	+5	+7	+6	+2		+4
+25.....	+2		+2	+3	+5	+4	+3	+4	+3	+1		+3
+10.....	+1	+1	0	+9	+1	+2	+2	+1	+2	+1	+4	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-1	-.6	0	-1	-2	-2	-2	-2	-2	-1	-2	-1
-25.....	-4	-2	-3	-3	-5	-5	-4	-5	-4	-4	-7	-4
-50.....	-9	-8	-7	-6	-10	-13	-11	-11	-12	-9	-1	-9
-100, no application.....	-30	-21	-27	-16	-28	-21	-22	-30	-26	-22	-1	-9

TABLE 36.—*Vegetables in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okla.	Tex.	Weighted average for States reporting
Acreages and yields:														
Planted acreage.....1,000 acres.....	88	123	120	187	365	17	42	67	71	58	133	35	411	1,717
Harvested acreage.....do.....	50	66	66	114	255	4	19	24	22	38	29	30	343	1,060
Total production.....1,000 tons.....	176	178	141	302	1,113	8	68	66	62	71	67	46	785	3,083
Average yield.....tons per acre.....	4	3	2	3	4	2	4	3	3	2	2	2	2	3
Do.....percent of potential.....														
Nitrogen:														
Total use.....short tons.....	2,175	3,304	2,415	2,992	14,600	323	536	1,763	1,911	1,300	2,876	490	2,670	37,355
Average use.....pounds per acre.....	50	54	40	32	80	38	26	63	54	45	43	28	13	43
Planted acreage fertilized with N.....percent.....	99	100	99	100	100	95	93	99	100	100	95	81	65	90
Predicted percent change in yield with change in N fertilizer rate														
Change in application rate, percent:														
+200.....			+40	+45		+29	+37			+54	+30	+22	+18	+30
+100.....		+24	+25	+28		+21	+22	+20	+22	+35	+23	+14	+10	+21
+50.....		+28	+14	+14	+16	+13	+13	+11	+13	+14	+20	+15	+7	+13
+25.....		+16	+8	+8	+9	+7	+7	+9	+6	+8	+10	+7	+3	+2
+10.....		+7	+3	+3	+4	+3	+2	+1	+3	+3	+4	+3	+1	+4
0, average use.....		0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....		-8	-3	-3	-4	-4	-3	-4	-3	-3	-4	-3	-2	-1
-25.....		-22	-9	-8	-9	-10	-8	-6	-9	-10	-12	-8	-4	-8
-50.....		-46	-18	-18	-19	-22	-16	-14	-19	-21	-24	-18	-9	-7
-100, no application.....		-100	-47	-42	-43	-54	-36	-27	-44	-48	-53	-45	-22	-41
Phosphoric oxide:														
Total use.....short tons.....	4,350	4,284	5,389	5,984	25,550	363	1,276	2,040	1,704	1,081	4,854	560	4,272	61,707
Average use.....pounds per acre.....	99	70	89	64	140	43	61	66	48	38	73	32	21	72
Planted acreage fertilized with P ₂ O ₅.....percent.....	99	100	99	100	100	95	93	99	100	100	95	81	65	90
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate														
Change in application rate, percent:														
+200.....				+2		+24		+17	+31	+53		+2	+3	+8
+100.....				+2		+14	+15	+8	+13	+18	+11	+1	+1	+7
+50.....		+2		+0.3	+2	+8	+9	+5	+7	+9	+6	+6	+1.6	+4
+25.....		+2	0	+2	+2	+3	+4	+2	+3	+3	+2	+2	+2	+2
+10.....		+0.5	0	+0.08	+1	+3	+4	+2	+3	+3	+2	+2	+2	+2
0, average use.....		0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....		-4	-5	-5	-9	-9	-3	-4	-2	-3	-5	-3	-3	-1
-25.....		-11	-5	-2	-3	-5	-8	-11	-7	-8	-13	-8	-7	-5
-50.....		-37	-7	-6	-7	-15	-18	-21	-16	-17	-25	-20	-2	-12
-100, no application.....		-100	-19	-20	-20	-54	-39	-47	-36	-38	-55	-46	-10	-84
Potash:														
Total use.....short tons.....	3,263	3,213	4,090	4,488	21,900	283	740	1,287	1,032	719	2,911	280	2,136	46,342
Average use.....pounds per acre.....	74	52	69	48	120	33	35	40	29	25	44	16	10	50
Planted acreage fertilized with K ₂ O.....percent.....	99	100	99	100	100	95	93	99	100	100	95	81	65	90
Predicted percent change in yield with change in K ₂ O fertilizer rate														
Change in application rate, percent:														
+200.....						+19		+4	+13	+46	-2	+3	+4	+7
+100.....		-0.9	0	+11	+6	+13	+14	+7	+11	+30	+6	+2	+3	+7
+50.....		-3	0	+9	+6	+8	+7	+5	+6	+18	+5	+2	+1	+4
+25.....		+2	0	+6	+5	+4	+4	+3	+3	+8	+3	+1	+5	+3
+10.....		0	+0.08	0	+2	+2	+2	+1	+0.9	+1	+4	+0.9	+0.6	+0.3
0, average use.....		0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....		+7	-3	0	-2	-3	-2	-2	-2	-2	-4	-1	-6	-7
-25.....		+7	-7	0	-4	-9	-4	-5	-5	-4	-9	-3	-1	-3
-50.....		-7	-2	-1	-10	-23	-4	-9	-10	-6	-22	-9	-2	-9
-100, no application.....		-19	-12	-8	-27	-64	-20	-19	-16	-14	-43	-20	-8	-6

TABLE 37.—*Fruits and nuts in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Va. ¹	N. C.	S. C.	Ga.	Fla.	Ky. ¹	Tenn. ¹	Ala.	Miss. ²	Ark.	La.	Oklahoma. ¹	Tex. ¹	Weighted average for States reporting
Acreages and yields:														
Planted acreage.....1,000 acres.....	85	139	72	243	551	81	73	73	90	87	80	117	200	1,891
Harvested acreage.....do.....														
Total production.....1,000 tons.....														
Average yield.....tons per acre.....														
Do.....percent of potential.....														
Nitrogen:														
Total use.....short tons.....	1,375	1,875	716	2,916	22,969	400	123	1,314	1,870	1,125	1,666	308	3,012	39,669
Average use.....pounds per acre.....	32	27	20	24	83	10	3	36	42	26	42	5	30	42
Planted acreage fertilized with N percent.....	65	90	47	100	97	20	29	82	97	75	84	22	32	74
Change in application rate, percent:														
+200.....	+67	+15	+142	+56		+37	+67			+70	+24	+17	+28	+32
+100.....	+42	+10	+58	+32		+18	+36	+13	+14	+42	+16	+10	+16	+17
+50.....	+24	+5	+25	+16		+9	+16	+8	+6	+22	+9	+7	+8	+14
+25.....	+11	+3	+12	+8		+10	+4	+11	+5	+11	+4	+3	+4	+7
+10.....	+4	+1	+4	+2		+4	+1	+3	+2	+1	+6	+2	+1	+3
0, average use.....	0	0	0	0		0	0	0	0	0	0	0	0	0
-10.....	-4	-1	-4	-6		-4	-1	-4	-2	-2	-2	-1	-2	-3
-25.....	-16	-2	-9	-10		-11	-3	-10	-6	-6	-9	-5	-4	-8
-50.....	-33	-5	-17	-21		-22	-8	-23	-13	-15	-17	-13	-7	-10
-100, no application.....	-62	-10	-35	-48		-40	-18	-25	-28	-32	-28	-29	-10	-18
Phosphoric oxide:														
Total use.....short tons.....	688	1,500	1,103	5,832	25,390		195	1,472	609	1,127	2,200	380	625	41,121
Average use.....pounds per acre.....	16	22	31	48	92		5	40	14	26	55	6	6	45
Planted acreage fertilized with P ₂ O ₅ percent.....	65	90	47	100	96		29	82	97	75	84	22	32	76
Change in application rate, percent:														
+200.....	+110	+21	+147	+5		+8		+20	+192	+8	+39	+3	+28	+28
+100.....	+60	+12	+100	+4		+2		+12	+117	+7	+15	+2	+18	+18
+50.....	+30	+6	+53	+3		+8		+6	+3	+50	+6	+7	+1	+8
+25.....	+15	+2	+23	+2		+6		+4	+1	+25	+5	+4	+6	+5
+10.....	+5	+1	+7	+1		+8		+3	+5	+12	+2	+2	+2	+2
0, average use.....	0	0	0	0		0	0	0	0	0	0	0	0	0
-10.....	-5	-1	-10	-2		-1		-4	-3	-4	-2	-2	-5	-2
-25.....	-15	-3	-17	-6		-3		-7	-6	-17	-5	-4	-7	-5
-50.....	-25	-8	-27	-14		-6		-2	-14	-10	-34	-13	-8	-1
-100, no application.....	-55	-14	-47	-40		-14		-3	-32	-17	-68	-34	-15	-2
Potash:														
Total use.....short tons.....	550	1,125	1,074	4,374	32,546		195	1,191	435	766	1,500	190	12	43,958
Average use.....pounds per acre.....	13	16	30	36	118		5	33	10	18	38	3	0.1	49
Planted acreage fertilized with K ₂ O percent.....	60	90	47	100	97		29	82	97	75	84	17	10	73
Change in application rate, percent:														
+200.....	+94	+68	+54		+3	+56		+22	+89	+20	+24	+0.1	+28	+28
+100.....	+49	+34	+46	+35	+2	+24		+17	+12	+67	+18	+12	+5	+19
+50.....	+28	+15	+27	+32	+1	+12		+13	+4	+24	+11	+6	+3	+11
+25.....	+8	+8	+14	+15	+0.4	+11		+6	+3	+8	+5	+3	+0.009	+5
+10.....	+2	+4	+4	+8	+2	+2		+2	+1	+2	+2	+1	+0.004	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-3	-4	-6	-8	-0.07	-2		-4	-2	-3	-2	-1	-0.005	-2
-25.....	-10	-8	-12	-12	-4	-4		-8	-3	-5	-6	-3	-0.01	-5
-50.....	-30	-19	-27	-37	-9	-11		-16	-9	-11	-13	-6	-0.03	-12
-100, no application.....	-45	-34	-51	-74	-2	-12		-33	-15	-19	-36	-12	-0.06	-23
Predicted percent change in yield with change in N fertilizer rate														
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate														
Predicted percent change in yield with change in K ₂ O fertilizer rate														

¹ Fruit only. ² Nuts only.

TABLE 38.—*Hay in the southern region: Estimated average yield (tons per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okla.	Tex.	Weighted average for States reporting
Nitrogen rate:													
160													
120													
80	2.3		2.2										
40	1.9		1.9	2.0									
20	1.7		1.7	1.7									
10	1.6		1.4	1.5									
0	1.5		1.2	1.2									
Average use (cf. table 39)	1.5		1.3	1.4									
Phosphoric oxide rate:													
160													
120													
80													
40	1.8	1.6	2.0	1.6	2.0	2.1	3.2	1.5	1.9	2.5	1.8	1.4	2.2
20	1.5	1.4	1.6	1.4	1.8	1.9	2.5	1.3	1.6	2.1	1.5	1.2	1.9
10	1.3	1.2	1.3	1.1	1.6	1.8	2.2	1.2	1.4	1.8	1.3	1.1	1.4
0	1.1	.8	.9	1.0	1.3	1.7	1.7	1.0	1.0	1.5	1.0	1.0	1.2
Average use (cf. table 39)	1.3	.9	1.3	1.1	1.4	1.9	2.7	1.2	1.2	1.8	1.5	1.3	1.4
Potash rate:													
160													
120													
80													
40	1.8	1.5	2.4	1.5	2.0		3.1	3.3	2.0	2.8		1.1	3.4
20	1.7	1.3	2.1	1.3	1.9		2.6		1.9	2.5		1.1	1.9
10	1.6	1.2	1.8	1.2	1.8		2.4		1.5	1.9		1.1	1.6
0	1.5	1.0	1.5	1.0	1.7		2.0		1.2	1.2		1.1	1.4
Average use (cf. table 39)	1.6	1.1	1.7	1.1	1.7		2.6		1.3	1.4		1.1	1.5

TABLE 39.—*Hay in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okla.	Tex.	Weighted average for States reporting
Acreages and yields:													
Planted acreage	1,066	1,181	722	268	1,870	1,680	467	654	1,070	153	982	1,000	11,113
Harvested acreage	1,351	1,140	422	979	1,898	1,611	717	748	1,273	316	1,331	1,149	12,935
Total production	1,719	1,246	344	604	2,633	2,126	616	1,041	1,623	441	1,855	1,281	15,529
Average yield	1.3	1.1	.8	.6	1.4	1.3	.9	1.4	1.3	1.4	1.4	1.1	1.2
Do	56	69	33	25	70	54	26	88	59	50	78	50	58
Nitrogen:													
Total use	239	236	422	564					1,080	60		2,500	5,101
Average use	.4	.4	1	4					2	.8		5	2
Planted acreage fertilized with N	20	20	25	70					20	25		50	29
Change in application rate, percent:													
+200	+0.4	+4	+10						+6	+2		+15	+6
+100	+.2	+2	+5						+3	+1		+9	+4
+50	+.2	+.6	+3						+1	+7		+3	+1
+25	+.1	+.5	+2						+.6	+3		+1	+.6
+10	+.09	+.06	+.8						+.2	+1		+.5	+.2
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.01	-.1	-.8						-.3	-.1		-.4	-.2
-25	-.04	-.6	-.2						-.9	-.4		-3	-1
-50	-.09	-.1	-.5						-2	-.8		-4	-2
-100, no application	-.3	-.3	-10						-2	-2		-10	-4
Phosphoric oxide:													
Total use	5,736	708	4,055	1,128	4,220	12,000	6,237	3,017	1,906	900	8,190	15,000	63,097
Average use	11	1	11	8	4	14	27	9	4	12	17	30	11
Planted acreage fertilized with P ₂ O ₅	20	20	25	70	9	35	25	13	20	25	28	50	25
Change in application rate, percent:													
+200	+22	+11	+34	+41	+17	+14	+26	+18	+23	+29	+22	+17	+20
+100	+11	+6	+20	+18	+10	+7	+18	+10	+12	+17	+14	+14	+11
+50	+6	+3	+10	+9	+5	+4	+10	+5	+6	+9	+8	+9	+6
+25	+3	+1	+5	+3	+2	+2	+6	+3	+3	+5	+4	+6	+3
+10	+.3	+.5	+2	+2	+1	+.7	+3	+1	+1	+2	+2	+2	+1
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.1	-.4	-.2	-.3	-.1	-.8	-.3	-.1	-.1	-.2	-.2	-.3	-.1
-25	-.2	-.1	-.6	-.7	-.2	-.8	-.3	-.3	-.5	-.6	-.5	-.5	-.3
-50	-.5	-.3	-15	-12	-.5	-4	-16	-.5	-.6	-10	-12	-11	-7
-100, no application	-11	-7	-30	-28	-10	-8	-36	-11	-12	-19	-33	-26	-16
Potash:													
Total use	2,151	3,068	2,133	846	530		4,730		1,016	222		1,250	15,946
Average use	4	5	6	6	.6		20		2	3		2	4
Planted acreage fertilized with K ₂ O	20	20	25	70	3		25		20	24		50	22
Change in application rate, percent:													
+200	+4	+13	+17	+20	+0.5		+11		+6	+25		+7	+7
+100	+2	+8	+11	+11	+.2		+7		+3	+12		+6	+4
+50	+1	+4	+6	+6	+2		+4		+1	+6		+4	+2
+25	+.7	+2	+3	+4	+0.8		+2		+7	+3		+2	+1
+10	+.4	+.8	+1	+1	+0.03		+1		+3	+1		+1	+4
0, average use	0	0	0	0	0		0		0	0		0	0
-10	-.2	-.1	-.1	-.2	-.03		-.1		-.4	-.1		-.1	-.5
-25	-.1	-.3	-.3	-.3	-.1		-.3		-.8	-.3		-.2	-.1
-50	-.2	-.5	-.6	-.7	-.2		-.6		-.1	-.7		-.3	-.2

TABLE 40.—*Pasture and cover crops in the southern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Va.	N. C.	S. C.	Ga.	Fla.	Ky.	Tenn.	Ala.	Miss.	Ark.	La.	Okla.	Tex.	Weighted average for States reporting
Acres and yields:														
Planted acreage...1,000 acres	4,336	1,577	957	3,626	875	8,298	4,435	12,500	4,208	2,000	3,725	16,467	102,339	155,343
Harvested acreage...do														
Total production...1,000 tons														
Average yield...tons per acre														
Do...percent of potential														
Nitrogen:														
Total use...short tons	873	947	2,000	3,747	938	1,804	3,536	4,940	388	1,200	240	408	2,825	23,846
Average use...pounds per acre	.4	1	4	2	2	.4	2	4	.2	1	.1	.05	.06	.3
Planted acreage fertilized with N...percent	20	40	35	20	25	1	16	-----	10	20	5	1	1	4
Predicted percent change in yield with change in N fertilizer rate														
Change in application rate, percent:														
+200.....	+3	+0.6	+12	+8	+9	+1	+6	+13	+0.3	+4	+0.5	+0.9	+1	+2
+100.....	+2	+4	+7	+4	+4	+8	+3	+7	+2	+2	+3	+4	+1	+1
+50.....	+5	+3	+4	+2	+2	+5	+1	+4	+0.8	+9	+2	+2	+5	+6
+25.....	+1	+2	+2	+9	+1	+2	+7	+1	+0.5	+4	+0.7	+0.8	+3	+3
+10.....	+0.5	+2	+6	+5	+5	+0.6	+3	+7	+0.2	+1	+0.2	+0.3	+1	+1
-10.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-25.....	-2	-2	-6	-8	-7	-0.7	-0.7	-7	-0.2	-2	-0.2	-0.3	-2	-2
-50.....	-3	-1	-2	-2	-1	-2	-1	-2	-0.7	-5	-0.8	-0.8	-4	-4
-100, no application.....	-5	-2	-4	-2	-3	-5	-2	-5	-0.8	-1	-2	-2	-6	-7
Phosphoric oxide:														
Total use...short tons	26,155	15,144	13,239	24,848	4,218	25,379	10,608	18,585	17,077	4,000	4,750	6,160	35,900	206,063
Average use...pounds per acre	12	19	28	14	10	6	5	15	8	4	3	.7	.7	3
Planted acreage fertilized with P ₂ O ₅ ...percent	20	40	35	20	25	8	16	25	10	20	5	1	1	4
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate														
Change in application rate, percent:														
+200.....	+43	+48	+38	+44	+68	+9	+10	+58	+19	+1	+10	+3	+2	+7
+100.....	+27	+31	+26	+25	+39	+4	+5	+35	+11	+6	+1	+1	+1	+4
+50.....	+16	+16	+16	+13	+20	+2	+3	+17	+5	+3	+3	+6	+9	+2
+25.....	+9	+11	+8	+8	+10	+2	+1	+11	+1	+1	+1	+3	+6	+1
+10.....	+6	+4	+4	+3	+4	+1	+4	+2	+7	+6	+3	+1	+3	+0
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-2	-3	-4	-3	-4	-3	-5	-6	-2	-6	-4	-1	-3	-6
-25.....	-5	-9	-9	-7	-11	-6	-1	-9	-4	-2	-1	-4	-7	-1
-50.....	-12	-20	-20	-17	-22	-2	-3	-22	-7	-3	-2	-7	-9	-3
-100, no application.....	-31	-44	-49	-36	-42	-6	-7	-44	-21	-6	-4	-1	-1	-5
Potash:														
Total use...short tons	7,969	11,358	7,294	7,987	1,250	1,594	3,572	8,673	5,550	1,600	1,200	104	2,860	61,011
Average use...pounds per acre	4	15	15	4	3	.4	2	7	3	2	.6	.01	.06	.8
Planted acreage fertilized with K ₂ O...percent	20	40	35	20	25	6	16	25	10	20	5	1	1	4
Predicted percent change in yield with change in K ₂ O fertilizer rate														
Change in application rate, percent:														
+200.....	+5	+22	+21	+15	+28	+1	+0.7	+11	+2	+2	+6	+0.1	+0.8	+2
+100.....	+3	+15	+14	+8	+15	+5	+3	+5	+1	+1	+3	+0.7	+6	+1
+50.....	+1	+8	+7	+4	+7	+3	+2	+3	+6	+7	+1	+0.3	+4	+7
+25.....	+.9	+6	+4	+1	+1	+1	+1	+3	+4	+6	+2	+0.2	+3	+4
+10.....	+3	+2	+2	+5	+1	+0.6	+0.2	+1	+2	+0.8	+2	+0.06	+1	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-4	-2	-2	-7	-1	-0.5	-1	-2	-2	-2	-0.9	-3	-0.06	-2
-25.....	-1	-6	-5	-2	-3	-1	-2	-4	-3	-3	-7	-0.2	-2	-4
-50.....	-2	-11	-10	-4	-8	-2	-4	-7	-6	-7	-2	-0.4	-3	-8
-100, no application.....	-4	-27	-24	-7	-15	-7	-6	-8	-1	-1	-3	-0.8	-4	-1

¹ Revised. Does not include 1,300,000 acres of cover crops.

NORTH CENTRAL STATES

TABLE 41.—Corn grain in the north central region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Nitrogen rate:													
160	82		95		82								90
120	78	82	90		80								84
80	74	78	85	45	73	65	76	70	50	50	37	39	66
40	62	68	77	43	62	63	75	50	40	40	35	35	59
20	54	63	62	40	53	60	72	38	35	35	33	30	53
10	47	59	57	38	48	52	69	34	32	32	30	26	48
0	40	52	51	35	42	50	65	29	30	30	26	20	44
Average use (cf. table 42)	44	57	52	36	43	50	66	32	30	30	27	20	45
Phosphoric oxide rate:													
160	82		95		79								87
120	82		90		73	66							79
80	80	82	85	45	64	65	76	70					75
40	66	77	80	44	52	60	76	60	24		38	41	63
20	52	70	74	42	45	55	74	52	22	48	38	41	58
10	44	60	70	40	40	52	72	48	22	45	38	41	54
0	35	43	65	38	35	50	69	44	21	40	38	41	50
Average use (cf. table 42)	58	70	70	40	42	52	70	47	22	40	38	41	55
Potash rate:													
160			94		87								92
120			82	90	81								86
80			78	81	85	45	71	66					69
40			68	76	80	44	57	66	76	75			66
20			64	69	75	42	47	63	74	70			62
10			60	64	70	40	42	62	72	68			59
0			57	59	65	38	34	60	70	66			56
Average use (cf. table 42)			64	68	69	39	44	60	71	66			38
													35

TABLE 42.—Corn grain in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Acreages and yields:													
Planted acreage.....1,000 acres..	3,373	4,293	8,180	1,708	2,544	5,171	9,721	4,200	600	3,600	6,694	2,650	52,734
Harvested acreage.....do.....	3,206	4,233	7,987	1,346	1,221	3,936	9,402	4,033	422	3,072	6,572	2,494	47,924
Total production.....1,000 bushels..	166,712	209,534	407,337	52,494	53,724	155,472	441,894	181,485	9,284	86,016	243,164	88,537	2,095,653
Average yield.....bushels per acre..	52	50	51	39	44	40	47	45	22	28	37	36	44
Do.....percent of potential..	62	61	54	87	51	61	62	56	44	56	97	88	66
Nitrogen:													
Total use.....short tons..	11,214	13,523	11,046	1,281	3,562	1,810	8,416	10,080	750	150	8,025	663	70,700
Average use.....pounds per acre..	7	6	3	2	3	.7	2	5	2	.08	2	.5	3
Planted acreage fertilized with N.....percent..	95	90	30	50	71	35	32	30	50	1	7	5	37
Change in application rate, percent:													
+200.....	+20	+9	+8	+2	+10	+1	+2	+16	+4	+0.2	+6	+1	+6
+100.....	+10	+4	+4	+1	+5	+7	+2	+7	+2	+1	+3	+7	+3
+50.....	+4	+2	+2	+5	+2	+4	+1	+4	+1	+06	+1	+3	+2
+25.....	+2	+1	+1	+3	+9	+2	+1	+2	+5	+03	+7	+1	+9
+10.....	+7	.7	.3	.4	.1	.07	.6	.6	.2	.01	.3	.04	.4
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-1	-9	-4	-1	-7	-0.07	-3	-6	-2	-0.1	-6	-0.08	-4
-25.....	-3	-2	-8	-3	-1	-1	-1	-6	-5	-0.03	-1	-2	-1
-50.....	-6	-3	-1	-6	-2	-4	-4	-9	-1	-0.06	-2	-5	-2
-100, no application.....	-10	-8	-1	-1	-2	-7	-1	-8	-2	-1	-3	-1	-3
Phosphoric oxide:													
Total use.....short tons..	48,060	46,365	42,960	7,686	17,808	18,100	18,033	16,380	4,500	225	359	633	221,109
Average use.....pounds per acre..	28	22	10	9	14	7	4	8	15	.1	.1	.5	8
Planted acreage fertilized with P ₂ O ₅.....percent..	95	90	30	50	71	35	33	30	50	1	4	5	36
Change in application rate, percent:													
+200.....	+36	+16	+11	+7	+24	+7	+3	+13	+13	+0.02	0	0	+9
+100.....	+25	+11	+7	+5	+13	+3	+2	+6	+6	+01	0	0	+6
+50.....	+15	+6	+4	+2	+6	+2	+1	+3	+3	+006	0	0	+3
+25.....	+8	+4	+2	+9	+4	+8	+6	+2	+2	+003	0	0	+2
+10.....	+4	+1	+4	+3	+1	+3	+1	+5	+4	+001	0	0	+5
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-4	-2	-2	-3	-1	-3	-6	-5	-6	-001	0	0	-1
-25.....	-9	-6	-3	-1	-4	-8	-8	-2	-2	-003	0	0	-2
-50.....	-19	-12	-4	-2	-7	-3	-2	-3	-3	-006	0	0	-4
-100, no application.....	-40	-38	-7	-5	-17	-3	-2	-7	-6	-01	0	0	-9
Potash:													
Total use.....short tons..	38,448	40,569	30,720	5,124	17,808	4,525	9,616	5,040			30	132	152,012
Average use.....pounds per acre..	22	19	8	6	14	2	2	2			.009	.1	6
Planted acreage fertilized with K ₂ O.....percent..	95	90	30	50	71	35	27	30			.1	5	37
Change in application rate, percent:													
+200.....	+18	+15	+10	+6	+31	+1	+1	+2			0	0	+7
+100.....	+9	+10	+6	+3	+16	+6	+5	+1			0	0	+4
+50.....	+5	+5	+3	+2	+9	+3	+2	+4			0	0	+2
+25.....	+2	+2	+1	+9	+6	+1	+1	+2			0	0	+9
+10.....	.8	+1	.4	+3	+3	+0.05	+0.05	+0.07			0	0	+4
0, average use.....	0	0	0	0	0	0	0	0			0	0	0
-10.....	-8	-1	-1	-3	-3	-0.07	-0.05	-0.08			0	0	-5
-25.....	-3	-4	-2	-1	-5	-1	-1	-2			0	0	-1

Predicted percent change in yield with change in K₂O fertilizer rate

FERTILIZER USE AND CROP YIELDS

TABLE 43.—Wheat in the north central region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Nitrogen rate:													
160			45										45
120			42	40									41
80		38	40	39	37								32
40	33	34	35	35	35	24	29	34					31
20	25	30	30	31	32	22	25	30					27
10	22	25	28	28	30	21	22	27					25
0	18	18	25	25	28	20	19	22					21
Average use (cf. table 44)	22	24	26	26	28	20	20	24					22
Phosphoric oxide rate:													
160			45										45
120			40	40									40
80		36	35	37	36								35
40	30	34	30	32	32	25	29	28	20	28	31	31	28
20	22	29	28	25	22	23	28	22	19	23	30	30	26
10	18	23	26	20	22	22	27	18	18	22	28	28	23
0	14	13	25	15	15	20	25	13	16	20	26	26	21
Average use (cf. table 44)	28	33	28	25	23	21	26	25	16	20	26	27	24
Potash rate:													
160			45										45
120			45	40									43
80		36	42	40	38								37
40	34	35	40	36	36	26							30
20	32	35	38	35	33	26	31	32					29
10	28	34	34	32	32	26	31	31					26
0	25	34	30	30	29	25	31	30					24
Average use (cf. table 44)	32	34	35	34	32	25	31	31					27

TABLE 44.—Wheat in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Acres and yields:													
Planted acreage..... 1,000 acres..	2,139	1,509	1,442	1,186	87	1,005	258	1,700	9,500	3,500	3,999	13,807	40,132
Harvested acreage..... do.....	2,118	1,479	1,376	1,141	86	921	262	1,362	8,706	3,278	3,879	12,280	36,888
Total production..... 1,000 bushels..	46,596	31,798	27,538	29,666	2,073	15,410	5,740	24,516	120,724	33,978	84,788	178,060	600,887
Average yield..... bushels per acre..	22	22	20	26	24	17	22	18	14	10	22	14	16
Do..... percent of potential..	61	58	44	65	63	55	71	51	70	36	71	45	56
Nitrogen:													
Total use..... short tons..	7,336	7,168	2,811	2,016	44	627	120	2,550	-----	5	417	33,807	36,901
Average use..... pounds per acre..	9	10	4	3	1	1	.9	3	-----	.003	.2	2	2
Planted acreage fertilized with N..... percent..	98	95	65	85	50	25	16	75	-----	1	1	20	32
Change in application rate, percent:													
+200.....	+30	+33	+7	+8	+2	+1	+5	+10	-----	+0.04	+0.8	+6	+8
+100.....	+16	+23	+3	+4	+8	+7	+2	+5	-----	+0.02	+3	+4	+5
+50.....	+8	+11	+.8	+2	+4	+4	+1	+2	-----	+0.08	+2	+2	+2
+25.....	+4	+4	+.6	+1	+1	+2	+.7	+1	-----	+0.04	+1	+1	+1
+10.....	+.9	+3	+.4	+.4	+.08	+.06	+.3	+.5	-----	+0.002	+0.04	+.4	+.5
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-1	-3	-.8	-.5	-.1	-.06	-.2	-.5	-----	-.002	-.1	-.4	-.5
-25.....	-4	-7	-2	-1	-.2	-.2	-.5	-.1	-----	-.004	-.2	-.1	-.1
-50.....	-9	-13	-2	-2	-.5	-.4	-.9	-.2	-----	-.008	-.3	-.2	-.2
-100, no application.....	-19	-25	-4	-4	-1	-.7	-2	-5	-----	-.02	-.4	-.4	-.5
Phosphoric oxide:													
Total use..... short tons..	33,536	25,087	16,397	12,096	522	2,510	820	25,500	3,500	10	489	27,614	148,081
Average use..... pounds per acre..	31	33	23	20	12	5	6	30	.7	.006	.2	4	7
Planted acreage fertilized with P ₂ O ₅ percent..	98	95	65	85	50	25	16	75	4	.1	1	20	26
Change in application rate, percent:													
+200.....	+34	+21	+41	+37	+8	+6	+41	+1	+0.02	+0.8	+5	+8	+8
+100.....	+23	+8	+10	+23	+21	+4	+3	+28	+.6	+.009	+4	+3	+5
+50.....	+14	+7	+5	+12	+13	+2	+1	+14	+3	+004	+2	+1	+3
+25.....	+9	+4	+4	+6	+6	+1	+.6	+8	+2	+002	+1	+.9	+2
+10.....	+3	+2	+2	+2	+2	+4	+2	+2	+0.06	+0.007	+.03	+4	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-5	-2	-.7	-3	-.2	-.4	-.4	-.3	-.06	-.0009	-.04	-.4	-.8
-25.....	-11	-6	-1	-.8	-.6	-.9	-.1	-.9	-.2	-.002	-.1	-.1	-.2
-50.....	-24	-17	-5	-18	-15	-2	-2	-20	-.3	-.005	-.2	-.2	-.4
-100, no application.....	-49	-59	-9	-39	-35	-4	-5	-48	-.8	-.01	-.5	-.4	-10
Potash:													
Total use..... short tons..	25,152	14,335	9,370	9,072	522	1,255	80	6,375	-----	-----	2,761	68,922	6
Average use..... pounds per acre..	21	19	13	15	12	2	.6	8	-----	-----	.4	42	42
Planted acreage fertilized with K ₂ O..... percent..	98	95	65	85	50	25	31	75	4	0	0	20	42
Change in application rate, percent:													
+200.....	+14	+14	+7	+11	+12	+1	0	+5	-----	-----	+0.8	+4	+4
+100.....	+9	+9	+4	+7	+7	+1	0	+2	-----	-----	+4	+2	+2
+50.....	+7	+7	+2	+4	+4	+5	0	+1	-----	-----	+1	+1	+1
+25.....	+3	+4	+1.8	+3	+2	+2	0	+.8	-----	-----	+0.08	+1	+1
+10.....	+1	+1	+.4	+1	+1	+1	0	+.4	-----	-----	+0.04	+.3	+.3
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-1	-.6	-.4	-1	-1	-.1	0	-.4	-----	-----	-.2	-.4	-.4

Predicted percent change in yield with change in N fertilizer rate

Predicted percent change in yield with change in N fertilizer rate													
+200.....	+14	+14	+7	+11	+12	+1	0	+5	-----	-----	+0.8	+4	+4
+100.....	+9	+9	+4	+7	+7	+1	0	+2	-----	-----	+4	+2	+2
+50.....	+7	+7	+2	+4	+4	+5	0	+1	-----	-----	+1	+1	+1
+25.....	+3	+4	+1.8	+3	+2	+2	0	+.8	-----	-----	+0.08	+1	+1
+10.....	+1	+1	+.4	+1	+1	+1	0	+.4	-----	-----	+0.04	+.3	+.3
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-1	-.6	-.4	-1	-1	-.1	0	-.4	-----	-----	-.2	-.4	-.4
Predicted percent change in yield with change in K ₂ O fertilizer rate													

TABLE 45.—*Rye in the north central region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Mo.	Weighted average for States reporting
Nitrogen rate:								
160			40					40
120			38					38
80		38	35	32	37			33
40		34	30	28	35	24	20	28
20	32	30	26	23	32	22	14	24
10	22	25	23	18	30	21	12	21
0	18	18	20	18	28	20	8	18
Average use (cf. table 46)	18	20	20	18	28	20	8	19
Phosphoric oxide rate:								
160			40					40
120			38					38
80	36		35	28	36		25	31
40	30	34	30	25	32	25	20	28
20	22	29	26	20	27	23	15	23
10	18	23	23	18	22	22	12	20
0	14	13	20	15	15	20	10	16
Average use (cf. table 46)	18	23	20	18	16	21	15	19
Potash rate:								
160			40					40
120			40					39
80		36	40	30	38	26		33
40	34	35	40	29	36	26	22	31
20	32	35	35	27	33	26	22	29
10	29	34	32	26	32	26	22	28
0	25	34	30	25	29	25	20	27
Average use (cf. table 46)	27	34	30	26	30	25	21	27

TABLE 46.—*Rye in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Mo.	Weighted average for States reporting
Acreages and yields:								
Planted acreage..... 1,000 acres.....	55	146	120	180	97	186	120	904
Harvested acreage..... do.....	35	59	62	65	92	162	36	511
Total production..... 1,000 bushels.....	665	826	868	1,040	1,150	2,349	468	7,366
Average yield..... bushels per acre.....	19	14	14	16	12	14	13	14
Do..... percent of potential.....	53	37	35	50	32	54	52	45
Nitrogen:								
Total use..... short tons.....	44	175	12	144	19	115	120	629
Average use..... pounds per acre.....	2	2	.2	2	.4	1	2	1
Planted acreage fertilized with N..... percent.....	40	40	5	40	20	25	50	31
Change in application rate, percent:								
+200	+14	+1	+6	+0.7	+1	+18	+7	+7
+100	+7	.4	+3	+4	.7	+9	+3	+3
+50	+2	.3	+2	+2	+3	+4	+2	+2
+25	.9	.2	.8	.07	+2	+3	+1	+1
+10	.3	.5	.1	.3	.04	.08	+1	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	-.3	-.6	-.09	-.6	-.04	-.06	-1	-.4
-25	-.5	-.2	-.1	-.08	-.2	-.3	-1	-1
-50	-1	-.4	-.2	-.2	-.3	-.6	-2	-2
-100, no application.....	-5	-8	-.5	-3	-.4	-.7	-12	-4
Phosphoric oxide:								
Total use..... short tons.....	264	701	54	864	88	460	1,200	3,631
Average use..... pounds per acre.....	10	10	.9	10	2	5	20	8
Planted acreage fertilized with P ₂ O ₅ percent.....	40	40	5	40	20	25	50	31
Change in application rate, percent:								
+200	+44	+44	+1	+26	+16	+8	+50	+25
+100	+28	.4	+14	+8	+4	+33	+15	+15
+60	+13	.3	+7	+4	+2	+17	+7	+7
+25	+8	.2	+4	+2	+1	+8	+4	+4
+10	+3	.04	+1	.8	.4	+3	+1	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	-2	-.04	-.2	-.8	-.4	-3	-2	-2
-25	-6	-.2	-.4	-.2	-1	-8	-4	-4
-60	-11	-20	-.3	-7	-4	-2	-17	-8
-100, no application.....	-23	-41	-.5	-14	-.8	-4	-33	-17
Potash:								
Total use..... short tons.....	132	701	54	648	175	230	300	2,240
Average use..... pounds per acre.....	5	10	.9	7	4	3	50	4
Planted acreage fertilized with K ₂ O..... percent.....	40	40	5	40	20	25	50	31
Change in application rate, percent:								
+200	+10	+2	+0.3	+5	+5	+1	+3	+3
+100	+4	.7	.2	+3	+3	+1	+2	+2
+60	+2	.4	.1	+2	+1	.5	+8	+9
+25	.9	.2	.1	.6	.6	+2	+4	+4
+10	.7	.04	.07	.2	.3	.1	+1	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	-.9	-.1	-.03	-.3	-.4	-.1	-2	-.2
-25	-.1	-.2	-.2	-.9	-.1	-.2	-.2	-.2
Predicted percent change in yield with change in N fertilizer rate								
+8	+14	+1	+6	+0.7	+1	+18	+7	+7
+5	+7	.4	+3	+4	.7	+9	+3	+3
+2	+4	.3	+2	+2	+3	+4	+2	+2
+1	.9	.2	.8	.07	+2	+3	+1	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	-.3	-.6	-.09	-.6	-.04	-.06	-1	-.4
-25	-.5	-.2	-.1	-.08	-.2	-.3	-3	-1
-50	-1	-.4	-.2	-.2	-.3	-.6	-6	-2
-100, no application.....	-5	-8	-.5	-3	-.4	-.7	-12	-4
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate								
+44	+44	+1	+26	+16	+8	+50	+25	+25
+22	+28	.4	+14	+8	+4	+33	+15	+15
+11	+13	.3	+7	+4	+2	+17	+7	+7
+5	+8	.2	+4	+2	+1	+8	+4	+4
+1	+3	.04	+1	.8	.4	+3	+1	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	-2	-.04	-.2	-.8	-.4	-3	-2	-2
-25	-6	-.2	-.4	-.2	-1	-8	-4	-4
-60	-11	-20	-.3	-7	-4	-2	-17	-8
-100, no application.....	-23	-41	-.5	-14	-.8	-4	-33	-17
Predicted percent change in yield with change in K ₂ O fertilizer rate								
+10	+2	+0.3	+5	+5	+1	+3	+3	+3
+4	.7	.2	+3	+3	+1	+2	+2	+2
+2	.4	.1	+2	+1	.5	+8	+9	+9
+1	.9	.2	.1	.6	.6	+2	+4	+4
0, average use.....	0	0	0	0	0	0	0	0
-10	-.9	-.1	-.03	-.3	-.4	-.1	-2	-.2
-25	-.1	-.2	-.2	-.9	-.1	-.2	-.2	-.2

FERTILIZER USE AND CROP YIELDS

TABLE 47.—Barley in the north central region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	N.Dak.	S. Dak.	Kans.	Weighted average for States reporting
Nitrogen rate:											
160				48		56					55
120				48		62					60
80				47	48	90	61				50
40				42	41	88	55	35			38
20				28	37	33	85	48	33		34
10				27	30	29	79	45	31		31
0				25	23	25	70	42	29		28
Average use (cf. table 48)				26	28	25	73		29		27
Phosphoric oxide rate:											
160					48		61				59
120					48	90	60	34			42
80					38	88	53	34			40
40					30	42	82	38	32		35
20					24	36	38	30	31		32
10					21	29	35	68	26		30
0					18	17	30	60	20		28
Average use (cf. table 48)					25	40	33	75	27		29
Potash rate:											
160						48					48
120						48	60				58
80						48	90	59	35		42
40						35	43	46	52		41
20						30	43	44	82		39
10						27	42	42	77		38
0						22	41	40	70		37
Average use (cf. table 48)						29	42	41	79		39

TABLE 48.—Barley in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	N. Dak.	S. Dak.	Kans.	Weighted average for States reporting
Acres and yields:											
Planted acreage..... 1,000 acres.....	37	26	40	120	214	1,316	54	2,700	1,400	500	6,407
Harvested acreage..... do.....	26	25	48	115	216	1,252	60	2,112	1,148	254	5,256
Total production..... 1,000 bushels.....	728	675	1,344	3,910	8,856	36,934	1,920	50,688	18,942	3,556	127,553
Average yield..... bushels per acre.....	28	27	28	34	41	30	32	24	16	14	24
Do..... percent of potential.....	74	57	58	38	66	86	84	86	32	39	70
Nitrogen:											
Total use..... short tons.....	112	111	24	204		198	40		7	250	946
Average use..... pounds per acre.....	7	8	1	3		.3	2		.01	1	.5
Planted acreage fertilized with N..... percent.....	95	95	30	85		10	17		1	5	10
Change in application rate, percent:											
+200.....	+9	+32	+4	+8		+0.5	+4		+0.05	+2	+1
+100.....	+4	+21	+2	+4		+2	+2		.03	+1	+.6
+50.....	+2	+10	+2	+2		+1	+.9		.02	+.5	+.3
+25.....	+1	+4	.8	+1		.07	.6		.006	.2	.2
+10.....	+10	+2	.3	.3		.02	.1		.003	.1	.06
0, average use.....	0	0	0	0		0	0		0	0	0
-10.....	-.7	-3	-.3	-.4		-.02	-.2		-.003	-.1	-.07
-25.....	-2	-4	-.8	-1		-.07	-.6		-.006	-.2	-.2
-50.....	-3	-10	-2	-2		-.2	-1		-.02	-.5	-.4
-100, no application.....	-5	-21	-2	-4		-.4	-2		-.04	-1	-.7
Phosphoric oxide:											
Total use..... short tons.....	420	370	108	1,224	1,541	1,320	180	1,200	15	313	6,691
Average use..... pounds per acre.....	23	28	5	20	14	2	7	.9	.02	1	2
Planted acreage fertilized with P ₂ O ₅ percent.....	95	95	30	85	60	10	17	4	.2	5	9
Change in application rate, percent:											
+200.....	+45		+12	+18	+44	+3	+9	+1	+0.01	+3	+4
+100.....	+28		+7	+12	+23	+2	+1	.7	.005	+1	+2
+50.....	+15		+7	+6	+11	+8	.9	.4	.002	.8	+1
+25.....	+8		+4	+5	+3	+6	+6	+2	.001	.4	.6
+10.....	+3		.7	+2	+1	+2	+1	.3	.0002	.1	.2
0, average use.....	0		0	0	0	0	0	0	0	0	0
-10.....	-2		-3	-.8	-1	-2	-.1	-.4	-.09	-.003	-.2
-25.....	-7		-2	-4	-6	-.4	-.8	-.2	-.0009	-.4	-.6
-50.....	-15		-5	-8	-13	-.8	-2	-.4	-.002	-.8	-1
-100, no application.....	-30		-58	-8	-18	-27	-2	-.8	-.002	-2	-3
Potash:											
Total use..... short tons.....	315	247	108	918	1,541	660	10				3,799
Average use..... pounds per acre.....	17	19	5	15	14	1	.4				4
Planted acreage fertilized with K ₂ O..... percent.....	95	95	30	85	60	10	34				25
Change in application rate, percent:											
+200.....	+25		+3	+6	+11	+14	+0.5	0			+3
+100.....	+15		+2	+2	+7	+8	+2	0			+2
+50.....	+8		+1	+1	+4	+3	+1	0			.9
+25.....	+4		.5	+1	+3	+2	+0.5	0			.6
+10.....	+3		.2	.2	+1	+1	.02	0			.3
0, average use.....	0		0	0	0	0	0	0			0

Predicted percent change in yield with change in N fertilizer rate

Predicted percent change in yield with change in N fertilizer rate

Predicted percent change in yield with change in P₂O₅ fertilizer rate

TABLE 49.—*Oats in the north central region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)		Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	S. Dak.	Kans.	Weighted average for States reporting
Nitrogen rate:												
160				85		65						77
120		69	69	80	60	78						75
80		62	69	75	60	81						70
40		53	68	60	55	70	54	55	60	52	36	57
20		45	60	50	48	60	50	53	44	43	32	58
10		40	53	42	44	52	46	50	35	40	30	45
0		35	46	35	40	46	40	45	25	35	28	39
Average use (cf. table 50)		37	48	35	41	49	40	45	27	35	28	40
Phosphoric oxide rate:												
160				85		75						81
120				85	67	68						76
80		61	74	84	60	62	52					68
40		55	74	66	58	50	49	54	65		39	58
20		45	72	55	52	43	45	52	55		37	60
10		40	68	50	49	40	43	50	50		34	47
0		34	61	45	45	35	40	47	45		30	43
Average use (cf. table 50)		44	70	46	49	40	41	49	54		32	46
Potash rate:												
160				85		80						83
120				85		78						81
80			74	85		69	56					69
40		58	73	82	60	62	56	55	73		63	
20		55	73	78	58	57	56	54	70		61	
10		50	73	77	55	54	56	54	68		60	
0		45	72	75	50	50	55	54	67		58	
Average use (cf. table 50)		50	72	77	53	56	55	54	68			60

TABLE 50.—*Oats in the north central region: Estimated percentage change in yield from increases or decreases from average application rates of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	S. Dak.	Kans.	Weighted average for States reporting
Acreages and yields:											
Planted acreage..... 1,000 acres..	1,181	1,487	4,048	1,517	2,880	5,278	6,520	1,746	3,100	1,200	28,957
Harvested acreage..... do.....	1,147	1,421	3,911	1,480	2,924	5,101	6,457	1,782	3,311	960	28,494
Total production..... 1,000 bushels..	41,292	52,577	166,218	58,460	141,814	188,737	264,737	55,242	87,742	21,120	1,077,939
Average yield..... bushels per acre..	36	37	42	40	43	37	41	31	26	22	38
Do..... percent of potential..	58	50	49	60	59	66	74	41	50	55	60
Nitrogen:											
Total use..... short tons..	1,890	2,045	1,620	1,092	5,040	892	5,000	1,284	12	1,200	20,075
Average use..... pounds per acre..	3	3	.8	1	4	.3	2	2	.008	2	1
Planted acreage fertilized with N..... percent..	80	55	20	48	70	10	17	37	.4	20	27

Change in application rate, percent:	Predicted percent change in yield with change in N fertilizer rate										
+200	+9	+9	+3	+2	+8	+0.8	+6	+10	+0.05	+5	+4
+100	+5	+5	+1	+1	+5	+4	+4	+5	+0.02	+3	+2
+50	+2	+1	+8	+3	+3	+2	+3	+3	+0.01	+1	+1
+25	+1	+1	+6	+1	+1	+1	+2	+2	+0.005	+6	+9
+10	+1	+1	+3	+0.4	+1	+0.04	+4	+4	+0.002	+2	+3
0, average use.....	0	0	0	0	0	0	0	0	0	0	0
-10	-.5	-.7	-.1	-.05	-.6	-.04	-.06	-.2	-.002	-.3	-.2
-25	-.8	-1	-.2	-.3	-.2	-.1	-.3	-.2	-.006	-.7	-.6
-50	-2	-2	-.4	-.8	-.5	-.3	-.4	-.3	-.01	-1	-1
-100, no application.....	-4	-3	-.6	-.2	-.6	-.4	-.7	-.7	-.03	-3	-2
Phosphoric oxide:											
Total use..... short tons..	11,340	9,814	7,290	6,552	20,160	5,280	23,433	12,840		3,000	99,709
Average use..... pounds per acre..	19	13	4	9	14	2	7	15		5	8
Planted acreage fertilized with P ₂ O ₅ percent..	80	55	20	48	70	10	17	37		20	30

Change in application rate, percent:	Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate										
+30	+5	+8	+10	+23	+3	+6	+27		+6	+10	
+18	+4	+3	+6	+12	+2	+3	+14		+3	+5	
+11	+3	+2	+3	+6	+8	+1	+7		+2	+3	
+5	+2	+1	+6	+2	+4	+3	+4		+8	+1	
+2	+1	+1	+4	+5	+1	+0.08	+2	+2	+3	+3	
0, average use.....	0	0	0	0	0	0	0	0	0	0	0
-10	-2	-1	-.8	-.5	-1	-.08	-2	-2		-.5	-1
-25	-6	-2	-1	-2	-4	-.3	-3	-4		-2	-2
-50	-11	-5	-2	-4	-7	-.7	-4	-7		-2	-4
-100, no application.....	-22	-12	-2	-8	-14	-.2	-5	-14		-3	-7
Potash:											
Total use..... short tons..	5,670	6,134	7,290	4,368	20,160	2,640	2,480	3,210			51,952
Average use..... pounds per acre..	10	8	4	6	14	1	.8	4			4
Planted acreage fertilized with K ₂ O..... percent..	80	55	20	48	70	10	35	37			36

Change in application rate, percent:	Predicted percent change in yield with change in K ₂ O fertilizer rate										
+200	+11	+0.5	+2	+8	+14	+0.5	+0.1	+2		+3	
+100	+7	+4	+1	+4	+7	+3	+0.07	+8		+2	
+50	+4	+3	+5	+2	+4	+1	+0.05	+4		+9	
+25	+2	+1	+3	+9	+2	+0.07	+0.02	+2		+5	
+10	+1	+0.07	+3	+5	+9	+0.02	+0.009	+0.07		+2	
0, average use.....	0	0	0	0	0	0	0	0		0	0
-10	-1	-1	-.1	-.5	-.9	-.02	-.01	-.1			
-25	-2	-3	-.2	-.2	-.2	-.07	-.02	-.02			-.5

FERTILIZER USE AND CROP YIELDS

TABLE 51.—*Soybeans in the north central region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Ohio	Ind.	Ill.	Mich.	Wis.	Iowa	Mo.	N. Dak.	S. Dak.	Weighted average for States reporting
Nitrogen rate:										
160			45							45
120			45	32						45
80		28	45	32						40
40		28	42	30						37
20		28	40	28						35
10		27	39	27						34
0		27	38	25						34
Average use (cf. table 52)		27	38	25						34
Phosphoric oxide rate:										
160			45							45
120			45	32						44
80		32	44	32	32					41
40		32	40	30	30	32	32			34
20		28	35	28	28	31	31			32
10		27	33	26	26	30	30			30
0		25	26	25	25	29	29			28
Average use (cf. table 52)		26	27	30	27	25	29	29	29	29
Potash rate:										
160			45							
120			45	32	32					39
80		32	41	32	32					36
40		30	27	36	30	31	32			32
20		29	26	32	29	32	32			30
10		28	25	30	27	32	32			29
0		24	24	28	24	31				27
Average use (cf. table 52)		26	24	28	26	24	31			27

TABLE 52.—*Soybeans in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Iowa	Mo	N. Dak.	S. Dak.	Weighted average for States reporting
Acres and yields:										
Planted acreage..... 1,000 acres.....	1,118	1,797	3,965	115	61	1,818	1,175	50	35	10,134
Harvested acreage..... do.....	1,056	1,591	3,948	117	24	1,921	1,191	41	66	9,955
Total production..... 1,000 bushels.....	23,232	35,002	94,752	2,282	348	42,262	27,393	430	825	226,526
Average yield..... bushels per acre.....	22	22	24	20	14	22	23	10	12	23
Do..... percent of potential.....	69	78	53	62	44	69	68	34	41	64
Nitrogen:										
Total use..... short tons.....		808	357	57						
Average use..... pounds per acre.....		.9	.2	1						
Planted acreage fertilized with N..... percent.....		45	3	50						
Change in application rate, percent:										
+200	+0.7	0	+1				+0.2			+0.2
+100	+.3	0	+.6				+.08			+.1
+50	+.2	0	.3				.05			.06
+25	+.1	0	.1				.02			.03
+10	.07	0	.03				.008			.02
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-.04	0	-.2				-.006			-.01
-25	-.1	0	-.4				-.02			-.04
-50	-.2	0	-.6				-.05			-.07
-100, no application.....	-.3	0	-.9				-.08			-.1
Phosphoric oxide:										
Total use..... short tons.....		3,686	8,087	1,428	862	61	500	705	300	7
Average use..... pounds per acre.....		7	9	.7	15	2	.5	1	12	4
Planted acreage fertilized with P ₂ O ₅ percent.....		20	45	3	50	10	2	5	50	3
Change in application rate, percent:										
+200	+.7	+4	+0.9	+11	+2	+0.4	+0.8	+0.1	+0.06	+2
+100	+.3	+3	+.7	+5	+1	.3	+.4	.04	.03	+1
+50	+.2	+2	+.5	+3	.6	.2	.3	.03	.02	.9
+25	+.1	+1	+.3	.9	.3	.1	.1	.03	.01	.6
+10	.4	.3	.06	.5	.1	.06	.03	.02	.003	.1
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-.4	-.4	-.06	-.9	-.1	-.07	-.04	-.4	-.004	-.2
-25	-.8	-2	-.2	-.2	-.3	-.2	-.1	-.5	-.007	-.6
-50	-2	-3	-.3	-.4	-.6	-.3	-.2	-.8	-.01	-1
-100, no application.....	-5	-4	-.7	-.8	-1	-.4	-.5	-1	-.03	-2
Potash:										
Total use..... short tons.....		3,686	8,087	1,428	431	61	300	-----	-----	13,993
Average use..... pounds per acre.....		7	9	.7	8	2	.3	-----	-----	3
Planted acreage fertilized with K ₂ O..... percent.....		20	45	3	50	10	2	-----	-----	13
Change in application rate, percent:										
+200	+10	+5	+0.3	+11	+3	+0.05				+8
+100	+5	+3	+.2	+6	+2	.03				+1
+50	+4	+2	+.1	+3	.9	.01				+1
+25	+2	+1	.07	+1	.4	.007				.5
+10	+1	.4	.03	.5	.2	.003				.2
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10	-1	-.5	-.04	-.5	-.2	-.001				-.2

TABLE 53.—*Sorghum grain, lint cotton, and tobacco in the north central region: Estimated average yield from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Sorghum grain (bushels per acre)			Lint cotton (pounds per acre)			Tobacco (pounds per acre)		
	Mo.	Kans.	Weighted average for States reporting	Ill.	Mo.	Weighted average for States reporting	Ohio	Ind.	Weighted average for States reporting
Nitrogen rate:									
160									1,822
120					826	826		1,748	1,742
80					756	756		1,615	1,615
40	32	32	32		662	662	1,600	1,432	1,644
20	28	28	28		504	504	1,530	1,325	1,462
10	25	25	25		424	424	1,500	1,262	1,421
0	22	22	22		350	350	1,455	1,200	1,370
Average use (cf. table 54)	24	22	22		455	455	1,525	1,648	1,566
Phosphoric oxide rate:									
160									1,495
120								1,495	1,495
80					816	813		1,415	1,439
40	29	29	29		509	770	767	1,210	1,277
20	28	28	28		476	742	739	1,015	1,320
10	27	27	27		455	724	721	850	1,117
0	26	26	26		429	700	697	700	1,248
Average use (cf. table 54)	26	26	26		444	732	729	1,385	1,003
Potash rate:									833
160									1,422
120					794	794		1,343	1,343
80					780	780		1,300	1,500
40					735	732	1,565	1,182	1,461
20	28	28	28		474	704	701	1,020	1,383
10	27	27	27		440	690	687	1,475	1,288
0	26	26	26		420	665	662	1,410	1,223
Average use (cf. table 54)	25	25	25		385	700	697	1,350	1,167
	25		25		402			1,600	1,343

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TABLE 54.—*Sorghum grain, lint cotton, and tobacco in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Sorghum grain			Lint cotton			Tobacco		
	Mo.	Kans.	Weighted average for States reporting	Ill.	Mo.	Weighted average for States reporting	Ohio	Ind.	Weighted average for States reporting
Acreages and yields:									
Planted acreage.....	150	3,040	3,190	5	440	445	20	10	30
Harvested acreage, 1,000 acres:									
Grain.....	23	1,754	1,777						
Silage.....	38	408	446						
Forage.....	54	860	914						
Syrup.....	4	2	6						
Total.....	119	3,024	3,143	4	425	429	21	10	31
Total production:									
Grain.....1,000 bushels.....	472	42,096	42,568						
Silage.....1,000 tons.....	361	3,468	3,829						
Forage.....do.....	124	1,806	1,930						
Syrup.....1,000 gallons.....	180	100	280						
Cotton.....1,000,000 pounds.....				1	127	128			
Tobacco.....1,000 pounds.....							24,610	12,850	37,460
Average yield:									
Grain.....bushels per acre.....	20	24	24						
Silage.....tons per acre.....	10	8	8						
Forage.....do.....	2	2	2						
Syrup.....gallons per acre.....	45	50	47						
Cotton or tobacco.....pounds per acre.....				271	298	298	1,172	1,285	2,457
Average yield.....percent of potential.....	62	75	75	50	36	36	73	70	72
Nitrogen:									
Total use.....short tons.....	300	480	780	3	2,904	2,907	180	472	652
Average use.....pounds per acre.....	4	.3	.5	1	13	13	18	90	43
Planted acreage fertilized with N.....percent.....	25	2	3	20	60	60	100	100	100
Predicted percent change in yield with change in N fertilizer rate									
+200.....	+10	+1	+1		+35	+35	+8		+8
+100.....	+5	.4	.6		+20	+20	+4		+7
+50.....	+3	.2	.3		+9	+9	+2		+8
+25.....	+2	.1	.2		+5	+5	+1		+4
+10.....	+1	.04	.06		+2	+2	.4		+2
0, average use.....	0	0	0	0	0	0	0	0	0
-10.....	-.8	-.04	-.08		-2	-2	-.4		-2
-25.....	-2	-.1	-.2		-6	-6	-1		-5
-50.....	-3	-.3	-.4		-11	-11	-2		-12
-100, no application.....	-7	-.4	-.7		-23	-23	-4		-12
Phosphoric oxide:									
Total use.....short tons.....	450	480	930	12	2,904	2,916	720	1,050	1,770
Average use.....pounds per acre.....	6	.3	.6	5	13	13	72	200	118
Planted acreage fertilized with P ₂ O ₅.....percent.....	25	2	3	20	60	60	100	100	100
Predicted percent change in yield with change in P₂O₅ fertilizer rate									
+200.....	+5	+0.4	+0.6	+5	+5	+5	+23	0	+15
+100.....	+3	.2	.3	+3	+3	+3	+16	0	+11
+50.....	+2	.1	.2	+1	+2	+2	+8	0	+5
+25.....	.8	.08	.09	.7	.9	.9	+4	0	+3
+10.....	.5	.02	.04	.3	.4	.4	+2	0	+1
0, average use.....	0	0	0	0	0	0	0	0	0
-10.....	-.4	-.02	-.04	-.3	-.4	-.4	-2	0	-1
-25.....	-2	-.04	-.1	-.6	-.9	-.9	-6	0	-4
-50.....	-2	-.08	-.2	-1	-2	-2	-15	0	-10
-100, no application.....	-5	-.2	-.4	-3	-4	-4	-50	-26	-42
Potash:									
Total use.....short tons.....	150	.....	150	12	3,960	3,972	720	945	1,665
Average use.....pounds per acre.....	2	.....	2	5	18	18	72	180	111
Planted acreage fertilized with K ₂ O.....percent.....	25	.....	25	20	60	60	100	100	100
Predicted percent change in yield with change in K₂O fertilizer rate									
+200.....	+2	+2	+5	+8	+8	+8	0	0	0
+100.....	+1	+1	+3	+4	+4	+4	0	0	0
+50.....	.6	+.6	+2	+2	+2	+2	0	0	0
+25.....	.3	+.3	.7	.7	.7	.7	0	0	0
+10.....	.1	+.1	.3	.2	.2	.2	0	0	0
0, average use.....	0	0	0	0	0	0	0	0	0
-10.....	-.1	-.1	-.3	-.5	-.5	-.5	0	0	0
-25.....	-.3	-.3	-.9	-1	-1	-1	-.6	-2	-1
-50.....	-.6	-.6	-2	-2	-2	-2	-4	-10	-6
-100, no application.....	-2	-.2	-4	-5	-5	-5	-16	-41	-24

TABLE 55.—Sugar beets in the north central region: Estimated average yield (tons per acre) from given application rate of N , P_2O_5 , and K_2O , 1950 basis

Average fertilizer rates (pounds per acre)	Ohio	Ind.	Mich.	Wis.	Minn.	Iowa	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Nitrogen rate:											
160					17						17
120		17	17		16		17				17
80	16	17	17		15		17				16
40	15	16	16		12		16	12	14	15	15
20	13	14	14		11		14	11	13	15	14
10	12	12	12		10		12	11	12	15	12
0	10	11	11		9		11	10	12	14	11
Average use (cf. table 56)	12	11	12		10		15	10	12	14	12
Phosphoric oxide rate:											
160					17	17					17
120		16	17		16	16	17				16
80	15	16	16		14	15	16	13	15	15	15
40	12	14	14		11	14	14	13	14	15	14
20	8	12	12		8	13	12	12	14	15	12
10	7	10	10		7	12	10	12	13	14	11
0	6	7	7		6	12	7	11	13	14	10
Average use (cf. table 56)	12	8	15		10	13	17	13	13	15	14
Potash rate:											
160					17	17	17				17
120		17	17		15	16	17				17
80	15	16	16		13	15	16	13			15
40	14	14	14		9	12	14	13			13
20	11	12	12		7	11	12	13			12
10	10	11	11		6	11	11	12			11
0	9	10	10		6	10	10	12			11
Average use (cf. table 56)	14	10	14		10	11	17	12			13

TABLE 56.—Sugar beets in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N , P_2O_5 , and K_2O , 1950 basis

Acreages, yields, and fertilizer use	Ohio	Ind.	Mich.	Wis.	Minn.	Iowa	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Acreages and yields:											
Planted acreage..... 1,000 acres.....	30	1	122	17	63	2	35	10	61	10	351
Harvested acreage..... do.....	22	5	98	8	43	.7	22	4	59	4	261
Total production..... 1,000 tons.....	277	6	1,020	84	437	6	222	49	812	45	2,958
Average yield..... tons per acre.....	13	12	10	10	10	9	10	12	14	11	11
Do..... percent of potential.....	76	70	59	59	59	53	67	75	93	73	69
Nitrogen:											
Total use..... short tons.....	150	5	549	69		32	88	7	167	157	1,220
Average use..... pounds per acre.....	10	1	9	8		27	5	1	5	32	8
Planted acreage fertilized with N..... percent.....	100	10	100	90		90	100	10	11	80	76
Change in application rate, percent:											
+200	+21	+7	+23	+14		+14	+6	0	+2	+3	+14
+100	+13	+1	+12	+6		+11	+4	0	+1	+2	+8
+50	+6	+6	+5	+4		+8	+2	0	+7	+1	+3
+25	+2	+2	+3	+3		+5	+8	0	+3	+7	+3
+10	+1	+09	+1	+1		+2	+6	0	+1	+3	+0
0, average use.....	0	0	0	0	0	0	0	0	0	0	-8
-10	-2	-09	-1	-1		-3	-6	0	-1	-3	-3
-25	-3	-3	-3	-2		-7	-8	0	-3	-8	-2
-50	-7	-7	-6	-4		-15	-2	0	-6	-2	-4
-100, no application.....	-13	-2	-12	-7		-28	-4	0	-1	-5	-8
Phosphoric oxide:											
Total use..... short tons.....	600	2	3,294	275	620	182	840	10	479	157	6,459
Average use..... pounds per acre.....	40	4	54	32	20	152	48	2	16	32	37
Planted acreage fertilized with P_2O_5 percent.....	100	10	100	90	50	90	100	10	31	80	75
Change in application rate, percent:											
+200	+42	+28	+15	+50	+12	0	+1	+0.9	+4	+3	+14
+100	+27	+15	+13	+29	+6	0	+1	+4	+2	+2	+10
+50	+15	+7	+9	+16	+3	0	+.7	+2	+1	+1	+6
+25	+8	+4	+4	+11	+2	0	+.2	+2	+.7	+7	+3
+10	+3	+1	+2	+4	+8	0	+.06	+1.05	+3	+3	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0
-10	-4	-2	-2	-8	-.9	0	-.09	-.05	-.4	-.3	-2
-25	-11	-3	-6	-14	-2	-1	-2	-.1	-1	-1	-4
-50	-22	-7	-14	-21	-4	-7	-6	-.2	-2	-2	-10
-100, no application.....	-50	-15	-53	-36	-7	-59	-16	-.5	-6	-8	-29
Potash:											
Total use..... short tons.....	600	2	2,196	413	310	546	175		30		4,272
Average use..... pounds per acre.....	40	4	36	49	10	455	10	2	1		26
Planted acreage fertilized with K_2O percent.....	100	10	100	90	50	90	100	10	7		71
Change in application rate, percent:											
+200	+23	+10	+24	+62	+12	0	+3		+0.07		+17
+100	+14	+4	+18	+41	+6	0	+3		+.04		+11
+50	+7	+2	+10	+21	+3	0	+2		+.02		+6
+25	+4	+1	+5	+11	+2	0	+.8		+.008		+3
+10	+1	+4	+3	+4	+.7	0	+.4		+.003		+2
0, average use.....	0	0	0	0	0	0	0	0	0	0	0
-10	-2	-4	-3	-4	-.9	0	-.4		-.004		-2

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TABLE 57.—*Flaxseed in the north central region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Mich.	Wis.	Minn.	Iowa	S. Dak.	Kans.	Weighted average for States reporting
Nitrogen rate:							
160							
120							
80							
40							
20							
10							
0							
Average use (cf. table 58)	6	7	7	7	6	8	7
Phosphoric oxide rate:							
160							
120							
80							
40							
20							
10							
0							
Average use (cf. table 58)	6	6	7	7	6	6	7
Potash rate:							
160							
120							
80							
40							
20							
10							
0							
Average use (cf. table 58)	6	6	6	6	6	6	6

TABLE 58.—*Flaxseed in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Mich.	Wis.	Minn.	Iowa	S. Dak.	Kans.	Weighted average for States reporting
Acreages and yields:							
Planted acreage.....1,000 acres.....	5	14	1,184	68	700	37	2,008
Harvested acreage.....do.....	5	9	1,205	82	503	27	1,831
Total production.....1,000 bushels.....	30	126	13,255	1,353	4,527	189	19,480
Average yield.....bushels per acre.....	6	14	11	16	9	7	11
Do.....percent of potential.....	46	108	85	123	69	27	81
Nitrogen:							
Total use.....short tons.....	1		444	40	4	37	526
Average use.....pounds per acre.....	.4		.8	1	.01	2	.5
Planted acreage fertilized with N.....percent.....	10		25	15	.2	10	16
Change in application rate, percent:							
+200.....	+2		+4	+5	+0.2	+27	+3
+100.....	+1		+2	+4	+2	+14	+2
+50.....	.4		+1	+2	+1	+8	+8
+25.....	.3		.5	.9	.09	+4	+4
+10.....	.2		.2	.4	.07	+2	+2
0, average use.....	0	0	0	0	0	0	0
-10.....	-.3		-.2	-.4	-.03	-2	-.2
-25.....	-.4		-.5	-.9	-.09	-4	-.4
-50.....	-.7		-1	-2	-.2	-8	-.9
-100, no application.....	-1		-2	-3	-.3	-16	-2
Phosphoric oxide:							
Total use.....short tons.....	6	8	2,960	200	7		3,181
Average use.....pounds per acre.....	2	1	5	6	.02		3
Planted acreage fertilized with P ₂ O ₅.....percent.....	10	15	25	15	.2		16
Change in application rate, percent:							
+200.....	+9	+4	+14	+15	+0.8		+9
+100.....	+4	+2	+7	+10	+4		+5
+50.....	+2	+1	+4	+6	+2		+3
+25.....	+1	.4	+2	+3	.09		+1
+10.....	.4	.2	.7	+1	.04		+5
0, average use.....	0	0	0	0	0		0
-10.....	-.4	-.2	-.7	-1	-.02		-.5
-25.....	-1	-.6	-2	-3	-.07		-1
-50.....	-2	-1	-4	-5	-.2		-3
-100, no application.....	-4	-2	-8	-9	-.4		-5
Potash:							
Total use.....short tons.....	3	8	1,480	10			1,501
Average use.....pounds per acre.....	1	1	2	.3			2
Planted acreage fertilized with K ₂ O.....percent.....	10	15	25	15			24
Change in application rate, percent:							
+200.....	+4	+4	+5	+1			+5
+100.....	+2	+2	+4	+5			+4
+50.....	+1	.9	+2	+2			+2
+25.....	.4	.4	.9	+1			+8
+10.....	.1	.1	.4	.07			+4
0, average use.....	0	0	0	0			0
-10.....	-.1	-.2	-.5	-.07			-.5
Predicted percent change in yield with change in N fertilizer rate							
+200.....	+2		+4	+5	+0.2	+27	+3
+100.....	+1		+2	+4	+2	+14	+2
+50.....	.4		+1	+2	+1	+8	+8
+25.....	.3		.5	.9	.09	+4	+4
+10.....	.2		.2	.4	.07	+2	+2
0, average use.....	0	0	0	0	0	0	0
-10.....	-.3	-.2	-.7	-1	-.03	-2	-.2
-25.....	-.4	-.5	-.9	-2	-.09	-4	-.4
-50.....	-.7	-1	-2	-3	-.2	-8	-.9
-100, no application.....	-1	-2	-8	-9	-.4	-16	-2
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate							
+200.....	+9	+4	+14	+15	+0.8		+9
+100.....	+4	+2	+7	+10	+4		+5
+50.....	+2	+1	+4	+6	+2		+3
+25.....	+1	.4	+2	+3	.09		+1
+10.....	.4	.2	.7	+1	.04		+5
0, average use.....	0	0	0	0	0		0
-10.....	-.4	-.2	-.7	-1	-.02		-.5
-25.....	-1	-.6	-2	-3	-.07		-1
-50.....	-2	-1	-4	-5	-.2		-3
-100, no application.....	-4	-2	-8	-9	-.4		-5
Predicted percent change in yield with change in K ₂ O fertilizer rate							
+200.....	+4	+4	+5	+1			+5
+100.....	+2	+2	+4	+5			+4
+50.....	+1	.9	+2	+2			+2
+25.....	.4	.4	.9	+1			+8
+10.....	.1	.1	.4	.07			+4
0, average use.....	0	0	0	0			0
-10.....	-.1	-.2	-.5	-.07			-.5

TABLE 59.—*Potatoes in the north central region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Nitrogen rate:													
160			320		410	410				198			390
120			300	362	365	365				198			352
80	387	500	246	325	307	307	500	350		197			330
40	338	475	186	275	230	226	475	332	228	179	194	194	253
20	285	446	149	203	180	180	446	300	212	164	186	186	214
10	243	422	125	164	145	145	422	276	203	156	183	183	189
0	200	398	100	125	108	108	398	257	193	150	180	180	163
Average use (cf. table 60)	325	418	139	200	145	112	403	322	196	152	181	185	195
Phosphoric oxide rate:													
160		476	325		412	368	476			190			382
120	362	442	300	400	404	337	442	354		190			370
80	300	390	250	383	358	280	390	326		190			329
40	225	306	185	325	269	187	306	280	232	180	187	187	242
20	162	239	150	275	200	133	239	260	225	170	179	179	203
10	128	197	125	212	150	104	197	248	218	160	175	175	173
0	100	150	100	150	88	70	150	230	213	150	165	165	141
Average use (cf. table 60)	362	331	202	377	196	104	187	272	230	155	178	183	233
Potash rate:													
160		359	350		405	375	359			202			370
120	362	314	300	400	349	325	314			195			347
80	300	255	250	374	263	263	255	350		182			295
40	200	188	150	322	159	185	188	300	239	168	194	194	222
20	150	150	117	250	104	138	150	276	225	160	194	194	183
10	125	118	105	200	75	106	119	284	222	154	192	192	160
0	100	100	94	150	50	75	100	252	214	150	192	192	137
Average use (cf. table 60)	362	277	133	375	188	106	103	291	219	150	192	192	228

TABLE 60.—*Potatoes in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Acreages and yields:													
Planted acreage..... 1,000 acres.....	39	19		10	97	75	100	9	17	120	15	53	11
Harvested acreage..... "do.....	38	19		9	97	77	98	10	17	117	15	52	10
Total production..... 1,000 bushels.....	7,600	4,845		882	17,460	15,018	17,640	1,300	2,346	22,230	2,250	11,700	1,060
Average yield..... bushels per acre.....	200	255		98	180	195	180	130	138	190	150	225	106
Do..... percent of potential.....	52	61		28	45	47	44	26	39	79	74	116	55
Nitrogen:													
Total use..... short tons.....	585	76		80	855	338	62	7	272	150	26	83	88
Average use..... pounds per acre.....	30	8		16	18	9	1	2	32	2	4	3	16
Planted acreage fertilized with N..... percent.....	100	80		80	98	60	25	20	50	42	23	6	80

Change in application rate, percent

Change in application rate, percent.	+200	+150	+100	+50	+25	+10	+2	+20	+2	+3	+2	+3	+180
+200	+21	+8	+43	+45	+37	+10	+2	+20	+2	+3	+2	+3	+180
+100	+15	+5	+25	+26	+21	+7	+1	+12	+2	+2	+2	+2	+110
+50	+8	+2	+12	+14	+10	+2	.7	+7	+1	.7	.4	.4	+50
+25	+4	+1	+7	+8	+4	+1	.4	+4	+5	.4	.3	.3	+25
+10	+2	.4	+2	+3	+2	.4	.2	+2	+2	.1	.1	.3	+10
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-4	.8	-1	-3	-2	.4	.2	-2	-3	-1	-1	.7	-10
-25	-12	-1	-7	-8	-5	-1	.4	-4	-5	-4	-2	-1	-30
-50	-15	-2	-16	-16	-14	-2	.7	-9	-8	-8	-4	-3	-50
-100, no application	-38	-5	-28	-37	-28	-5	-2	-20	-1	-2	-1	-4	-150

Phosphoric oxide:

Total use.....	short tons	2,340	456	240	3,420	720	500	30	272	1,800	35	359	176	10,348
Average use.....	pounds per acre	120	48	48	70	19	10	7	32	30	5	14	32	37
Planted acreage fertilized with P ₂ O ₅	percent	100	80	80	98	60	25	28	50	42	23	27	80	56

Change in application rate, percent

+200	+13	+42	+58	+6	+60	+57	+30	+26	-	+6	+5	-	+32
+100	+13	+23	+36	+6	+34	+28	+16	+13	-	+2	+3	-	+14
+50	+13	+16	+18	+6	+15	+14	+7	+6	-	+2	+2	-	+5
+25	+9	+9	+11	+4	+9	+7	+4	+3	-	+1	+1	-	+2
+10	+4	+3	+4	+1	+6	+2	+1	.9	-	+4.	+3	-	+5
0, average use	0	0	0	0	0	0	0	0	-	0	0	-	0
-10	-4	-4	-7	-3	-5	-2	-3	-1	-	-5	-6	-	0
-25	-13	-11	-13	-7	-11	-7	-4	-3	-	-2	-1	-	-5
-50	-27	-23	-22	-19	-24	-17	-8	-8	-	-3	-2	-	-6
-100, no application	-73	-55	-50	-61	-55	-31	-10	-15	-	-7	-3	-8	-34

Potash

Total use	short tons	2,340	912	160	4,275	2,025	500	7	272	450	9	32	46	10,985
Average use	pounds per acre	120	96	32	88	54	10	2	32	8	1	1	1	46
Planted acreage fertilized with K ₂ O	percent	100	80	80	98	60	25	20	50	41	23	8	5	5

Change in application rate, percent

+200	+64	+107	+4	+115	+48	+8	+25	+4	+0.8	0	+3
+100	+24	+38	+56	+4	+72	+25	+4	+2	+4	0	+2
+50	+16	+20	+31	+4	+40	+13	+2	+1	+2	0	+1
+25	+11	+11	+12	+2	+24	+6	+1	+3	+6	0	+0.08
+10	+5	+4	+4	+1	+12	+2	+4	+1	+2	0	+0.03
0, average use.	0	0	0	0	0	0	0	0	0	0	+
-10	-4	-7	-3	-2	-3	-3	-5	-1	-2	-0.05	-
-25	-13	-14	-7	-6	-15	-8	-1	-3	-6	-0.1	-
-50	-20	-25	-6	-13	-24	-14	-8	-1	-10	-0.2	-

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 TABLE 61.—*Vegetables in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	Kans.	Weighted average for States reporting
Acreages and yields:										
Planted acreage..... 1,000 acres.....	75	113	146	175	246	120	45	25	11	956
Harvested acreage..... do.....	50	120	122	105	239	126	24	18	1	805
Total production..... 1,000 tons.....	310	490	375	476	589	332	73	43	1	2,689
Average yield..... tons per acre.....	6	4	3	4	2	3	3	2	1	3
Do..... percent of potential.....										
Nitrogen:										
Total use..... short tons.....	600	799	1,310	1,212	1,096	162	178	125	100	5,582
Average use..... pounds per acre.....	16	14	18	14	9	3	8	10	18	12
Planted acreage fertilized with N..... percent.....	100	88	90	100	85	18	78	100	90	82
Predicted percent change in yield with change in N fertilizer rate										
Change in application rate, percent:										
+200.....	+44	+20	+8	+25	+6	+2	+13	+34	+21	+15
+100.....	+24	+13	+4	+16	+3	+1	+8	+16	+11	+9
+50.....	+11	+8	+2	+8	+1	+3	+3	+7	+6	+4
+25.....	+6	+5	+1	+4	+7	+2	+2	+3	+3	+2
+10.....	+3	+3	+6	+2	+3	+1	+6	+1	+1	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10.....	-3	-.6	-.5	-2	-.4	-.07	-.8	-.2	-.1	-.1
-25.....	-5	-2	-1	-4	-.8	-.2	-.4	-.3	-.3	-.2
-50.....	-12	-6	-2	-9	-1	-.7	-.6	-.8	-.8	-.4
-100, no application.....	-24	-19	-7	-18	-4	-2	-15	-16	-16	-11
Phosphoric oxide:										
Total use..... short tons.....	1,500	2,621	3,930	6,112	4,113	650	595	375	200	20,096
Average use..... pounds per acre.....	40	46	54	70	33	11	26	30	36	42
Planted acreage fertilized with P ₂ O ₅ percent.....	100	88	90	100	85	18	78	100	90	82
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate										
Change in application rate, percent:										
+200.....	+40	+11	+35	+26	+10	+40	+14	+1	+1	+25
+100.....	+27	+8	+25	+16	+6	+22	+26	+1	+1	+17
+50.....	+15	+15	+5	+14	+8	+3	+10	+15	+1	+10
+25.....	+6	+8	+3	+7	+5	+1	+5	+5	+7	+5
+10.....	+2	+3	+9	+2	+2	+5	+3	+2	+4	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10.....	-4	-3	-1	-2	-2	-.5	-2	-3	-.7	-.2
-25.....	-10	-7	-4	-9	-6	-1	-6	-9	-2	-6
-50.....	-21	-17	-8	-18	-12	-3	-12	-17	-2	-13
-100, no application.....	-50	-36	-21	-41	-28	-6	-25	-37	-10	-29
Potash:										
Total use..... short tons.....	1,312	2,621	2,620	4,500	4,113	650	218	125	50	16,209
Average use..... pounds per acre.....	35	46	36	51	33	11	10	10	9	34
Planted acreage fertilized with K ₂ O..... percent.....	100	88	90	100	85	18	78	100	90	82
Predicted percent change in yield with change in K ₂ O fertilizer rate										
Change in application rate, percent:										
+200.....	+51	+24	+8	+29	+29	+7	+16	+8	+4	+23
+100.....	+29	+17	+5	+23	+15	+4	+10	+5	+3	+14
+50.....	+14	+10	+3	+11	+8	+2	+5	+2	+2	+7
+25.....	+7	+5	+1	+7	+6	+8	+3	+7	+7	+4
+10.....	+2	+2	+6	+3	+2	+3	+7	+3	+4	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10.....	-3	-2	-.9	-3	-2	-.5	-1	-.5	-.2	-.2
-25.....	-8	-6	-2	-7	-4	-.9	-3	-1	-1	-4
-50.....	-16	-11	-4	-16	-10	-2	-5	-2	-2	-9
-100, no application.....	-34	-32	-10	-34	-20	-5	-14	-5	-6	-21

TABLE 62.—*Fruits in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Iowa	Mo.	Kans.	Weighted average for States reporting
Acreages and yields:								
Planted acreage..... 1,000 acres	291	55	76	271	4	85	16	798
Harvested acreage..... do								
Total production..... 1,000 tons								
Average yield..... tons per acre								
Do..... percent of potential								
Nitrogen:								
Total use..... short tons	1,314	96	460	4,880	28	266	13	7,057
Average use..... pounds per acre	9	4	12	36	14	6	2	18
Planted acreage fertilized with N..... percent	74	35	60	90	25	100	5	77
Predicted percent change in yield with change in N fertilizer rate								
+200	+17	+34	+3	+35	+44	+30	+14	+24
+100	+8	+18	+2	+24	+26	+17	+7	+15
+50	+5	+10	+1	+14	+16	+10	+3	+9
+25	+1	+6	.6	+7	+7	+5	+2	+4
+10	.7	+2	.2	+2	+2	+2	.6	+1
0, average use	0	0	0	0	0	0	0	0
-10	-1	-2	-2	-4	-3	-2	-.6	-2
-25	-5	-6	-.5	-10	-10	-5	-2	-6
-50	-8	-11	-1	-21	-19	-10	-4	-12
-100, no application	-16	-22	-2	-62	-50	-20	-7	-31
Phosphoric oxide:								
Total use..... short tons	1,256	48	1,380	4,880	1	—	—	7,565
Average use..... pounds per acre	9	2	36	36	.5	—	—	22
Planted acreage fertilized with P ₂ O ₅ percent	74	35	60	90	25	—	—	75
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate								
+200	+2	+0.6	+1	+2	+0.2	—	—	+2
+100	+1	.3	+1	+1	.09	—	—	+.9
+50	.7	.2	.7	.9	.04	—	—	+.7
+25	.3	.07	.2	.5	.01	—	—	+.3
+10	.2	.03	.1	.2	.006	—	—	+.2
0, average use	0	0	0	0	0	0	0	0
-10	-.3	-.05	-.2	-.2	-.01	—	—	-.2
-25	-.8	-.08	-.7	-.7	-.03	—	—	-.7
-50	-1	-.2	-.2	-.1	-.05	—	—	-1
-100, no application	-4	-.3	-3	-3	-.1	—	—	-3
Potash:								
Total use..... short tons	1,247	48	920	4,880	—	—	—	7,095
Average use..... pounds per acre	9	2	24	36	—	—	—	20
Planted acreage fertilized with K ₂ O..... percent	74	35	60	90	—	—	—	76
Predicted percent change in yield with change in K ₂ O fertilizer rate								
+200	+5	+0.7	+43	+3	—	—	—	+8
+100	+3	.4	+27	+2	—	—	—	+5
+50	+2	.2	+15	+1	—	—	—	+3
+25	.7	.1	.9	.7	—	—	—	+2
+10	.5	.06	.3	.2	—	—	—	+.6
0, average use	0	0	0	0	0	0	0	0
-10	-.6	-.05	-.4	-.2	—	—	—	-.7
-25	-1	-.1	-.9	-.8	—	—	—	-2
-50	-2	-.2	-.20	-.2	—	—	—	-4
-100, no application	-6	-.5	-57	-5	—	—	—	-11

TABLE 63.—*Dry beans and mint in the north central region: Estimated average yield (pounds per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Michigan	
	Dry beans	Mint
Nitrogen rate:		
160		
120		
80		
40	1,645	
20	1,524	
10	1,422	
0	1,230	
Average use (cf. table 64)	1,282	
Phosphoric oxide rate:		
160		
120		
80	1,626	
40	1,560	42
20	1,440	37
10	1,350	32
0	1,250	25
Average use (cf. table 64)	1,422	42
Potash rate:		
160		
120		
80		46
40	1,485	37
20	1,425	27
10	1,350	20
0	1,272	17
Average use (cf. table 64)	1,350	44

TABLE 64.—*Dry beans, mint, and bromegrass seed in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

	Dry	Mint	Bromegrass seed				
	beans		Mich.	Mich.	Iowa	Nebr.	
Acreages, yields, and fertilizer use							
Acreages and yields:							
Planted acreage.....	1,000 acres		481	15	10	35	45
Harvested acreage.....	do		420	15			
Total production.....	1,000,000 pounds		399				
Do.....	1,000 pounds			386			
Average yield.....	pounds per acre		950	26			
Do.....	percent of potential		58	56			
Nitrogen:							
Total use.....	short tons		577		250	167	417
Average use.....	pounds per acre		2		50	5	18
Planted acreage fertilized with N.....	percent		80				
Predicted percentage change in yield with change in N fertilizer rate							
Change in application rate, percent:							
+200.....			+9		+44	+50	+49
+100.....			+5		+42	+30	+33
+50.....			+3		+27	+20	+22
+25.....			+2		+14	+10	+11
+10.....			+1		+6	+4	+4
0, average use.....			0	0	0	0	0
-10.....			-2		-5	-4	-4
-25.....			-4		-15	-10	-11
-50.....			-4		-30	-20	-22
-100, no application.....			-4		-62	-30	-37
Phosphoric oxide:							
Total use.....	short tons		4,620	280			
Average use.....	pounds per acre		19	37			
Planted acreage fertilized with P ₂ O ₅	percent		80				
Predicted percentage change in yield with change in P₂O₅ fertilizer rate							
Change in application rate, percent:							
+200.....			+13				
+100.....			+8	+12			
+50.....			+5	+6			
+25.....			+3	+2			
+10.....			+2	+1.5			
0, average use.....			0	0	0	0	0
-10.....			-1	-1			
-25.....			-2	-4			
-50.....			-5	-14			
-100, no application.....			-12	-40			
Potash:							
Total use.....	short tons		2,310	560			
Average use.....	pounds per acre		10	75			
Planted acreage fertilized with K ₂ O.....	percent		80				
Predicted percentage change in yield with change in K₂O fertilizer rate							
Change in application rate, percent:							
+200.....			+9				
+100.....			+6	+2			
+50.....			+2	+5			
+25.....			+1	+6			
+10.....			+1.5	+2			
0, average use.....			0	0	0	0	0
-10.....			-5	-3			
-25.....			-1	-7			
-50.....			-3	-20			
-100, no application.....			-6	-62			

TABLE 65.—*Hay in the north central region: Estimated average yield (tons per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Nitrogen rate:													
160				4.0									4.0
120		3.4	3.5										3.3
80		3.4	3.0		3.7								3.3
40		3.2	2.0		3.0		3.0	2.6					1.9
20		3.0	1.7		2.4		2.8	2.0					2.7
10		2.8	1.6		2.0		2.6	1.7					2.4
0		2.6	1.5		1.6		2.5	1.5					2.0
Average use (cf. table 66)		2.7			1.6		2.6	1.6					1.1
Phosphoric oxide rate:													
160			3.3	4.0		3.9			3.5				3.7
120		3.5	3.2	4.0	3.5	3.6			3.3				3.5
80		3.0	2.8	4.0	3.5	3.3	2.8	3.0					3.1
40		2.3	2.4	4.0	3.2	2.8	2.2	2.8	2.2				2.7
20		1.9	1.9	3.1	2.8	2.6	1.8	2.5	1.6				2.3
10		1.7	1.7	2.5	2.5	2.4	1.7	2.2	1.2				2.1
0		1.5	1.5	2.1	2.0	2.2	1.5	2.0	.8				1.8
Average use (cf. table 66)		1.6	1.6	3.4	2.3	2.2	1.6	2.1	.9	1.5	2.0	2.5	2.0
Potash rate:													
160		3.4	3.2	4.0		3.9							3.7
120		3.2	3.1	4.0	3.5	3.7			3.5				3.5
80		3.0	2.7	3.0	3.4	3.3	2.8		3.1				3.1
40		2.4	2.0	2.0	3.1	2.7	2.8	2.9	2.6				2.6
20		2.0	1.6	1.7	2.7	2.3	2.8	2.8	2.3				2.4
10		1.7	1.4	1.6	2.3	2.0	2.7	2.8	2.1				2.2
0		1.4	1.2	1.6	2.0	1.8	2.5	2.8	1.9				2.0
Average use (cf. table 66)		1.5	1.2		2.2	1.8	2.6	2.8	1.9				2.3

TABLE 66.—*Hay in the north central region: Estimated percentage change in yields resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	S. Dak.	Nebr.	Kans.	Weighted average for States reporting
Acreages and yields:													
Planted acreage..... 1,000 acres	2,577	1,740	2,363	2,683	3,862	2,651	3,577	3,686	750	4,600	1,420	1,316	31,225
Harvested acreage..... do	2,680	1,850	2,797	2,735	3,946	3,812	3,648	3,686	3,679	4,677	4,532	1,950	39,992
Total production..... 1,000 tons	3,994	2,622	4,602	3,794	7,051	5,494	6,347	4,823	3,440	3,405	5,115	3,273	53,960
Average yield..... tons per acre	1.5	1.4	1.6	1.4	1.8	1.4	1.7	1.3	.9	1.7	1.1	1.7	1.3
Do..... percent of potential	43	41	40	40	45	35	57	36	43	21	33	52	39
Nitrogen:													
Total use..... short tons		174			1,236			1,080	891		25		1,152
Average use..... pounds per acre		.2			.6			.6	.5		.01		4,558
Planted acreage fertilized with N..... percent		10			8			7	4		1		35
Change in application rate, percent:													
+200	+0.6				+0.4			+0.5	+3		+0.05		+6
+100	+.4				+.3			+.2	+1		+.03		+3
+50	+.3				+.2			+.1	+.8		+.01		+2
+25	+.2				+.1			+.07	+.5		+.006		+.7
+10	+.1				+.06			+.04	+.2		+.003		+.3
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.1				-.09			-.04	-.1		-.003		-.5
-25	-.2				-.2			-.08	-.3		-.007		-.9
-50	-.3				-.2			-.2	-.6		-.02		-.4
-100, no application.....	-.4				-.3			-.3	-.7		-.04		-.6
Phosphoric oxide:													
Total use..... short tons	3,354	3,480	59,100	8,040	1,854	5,300	5,040	4,455	1,125	800	1,161	9,212	102,921
Average use..... pounds per acre	3	4	50	6	1	4	3	2	3	3	2	14	7
Planted acreage fertilized with P ₂ O ₅ percent	10	10	25	10	8	10	7	4	4	1	3	35	9
Change in application rate, percent:													
+200	+7	+12	+19	+23	+2	+10	+8	+22	+6	+0.1	+2	+10	+10
+100	+4	+6	+19	+14	+.9	+5	+3	+11	+3	+.06	+1	+6	+6
+50	+2	+3	+12	+5	+.4	+2	+2	+7	+2	+.03	+.5	+3	+3
+25	+1	+1	+7	+3	+.2	+1	+1	+3	+1	+.01	+.3	1	+2
+10	+.6	+.4	+4	+1	+.04	+.9	+.5	+.5	+.1	+.004	+.1	+.4	+.7
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.6	-.7	-4	-1	-.1	-.5	-.5	-.2	-.4	-.008	-.1	-.7	-.9
-25	-1	-1	-8	-4	-.2	-1	-1	-3	-1	-.02	-.3	-2	-2
-50	-2	-2	-23	-8	-.4	-3	-2	-4	-2	-.04	-.5	-4	-4
-100, no application.....	-3	-4	-55	-12	-.9	-5	-4	-6	-4	-.08	-1	-10	-8
Potash:													
Total use..... short tons	2,838	1,740		2,680	1,854	5,300	480	2,227				1,152	18,271
Average use..... pounds per acre	2	2		2	1	4	3	1				2	2
Planted acreage fertilized with K ₂ O..... percent	10	10		10	8	10	7	4				35	10
Change in application rate, percent:													
+200	+9	+6		+5	+4	+6	+0.2	+2				+6	+4
+100	+4	+2		+4	+2	+3	+1	+5				+4	+2
+50	+2	+1		+2	+8	+2	+0.5	+4				+4	+1
+25	+.7	+.8		+1	+.4	+.8	+.03	+.4				+.9	+.6
+10	+.3	+.3		+.5	+.2	+.4	+.02	+.3				+.4	+.3
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.4	-.5		-.5	-.2	-.4	-.02	-.5				-.9	-.4
-25	-.9	-.9		-1	-.5	-.8	-.04	-.8				-1	-.1
-50	-1	-1		-2	0	-2	-.05	-1				1	1

FERTILIZER USE AND CROP YIELDS

TABLE 67.—*Pasture and cover crops in the north central region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Ohio	Ind.	Ill.	Mich.	Wis.	Minn.	Iowa	Mo.	N. Dak.	Nebr.	Kans.	Weighted average for States reporting
Acreages and yields:												
Planted acreage..... 1,000 acres.....	4,000	4,751	5,200	1,800	3,600	1,316	8,012	200	260	1,800	19,309	50,248
Harvested acreage..... do.....												
Total production..... 1,000 tons.....												
Average yield..... tons per acre.....												
Do..... percent of potential.....												
Nitrogen:												
Total use..... short tons.....		238										
Average use..... pounds per acre.....		.1										
Planted acreage fertilized with N..... percent.....		5										
Predicted percent change in yield with change in N fertilizer rate												
Change in application rate, percent:												
+200.....		+2										
+100.....		+1										
+50.....		.5										
+25.....		.3										
+10.....		.1										
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....		-.2										
-25.....		-.3										
-50.....		-.6										
-100, no application.....		-1										
Phosphoric oxide:												
Total use..... short tons.....	11,200	4,751	78,000	5,400	1,080	2,640	1,200	5,400	500	2,636		112,867
Average use..... pounds per acre.....	6	2	30	6	.6	4	.3	54	4	3		7
Planted acreage fertilized with P ₂ O ₅ percent.....	20	5	15	10	5	10	1	90	19	9		9
Predicted percent change in yield with change in P₂O₅ fertilizer rate												
Change in application rate, percent:												
+250.....		+3										
+130.....		+1										
+50.....		.5										
+25.....		.3										
+10.....		.1										
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....		-.1										
-25.....		-.3										
-50.....		-.6										
-100, no application.....		-13										
Potash:												
Total use..... short tons.....	9,600	1,188										
Average use..... pounds per acre.....	5	.5										
Planted acreage fertilized with K ₂ O..... percent.....	20	5										
Predicted percent change in yield with change in K₂O fertilizer rate												
Change in application rate, percent:												
+200.....		+7										
+100.....		+4										
+50.....		+2										
+25.....		+1										
+10.....		.5										
0, average use.....	0	.05	0	0	.05	.08	.07	0	0	0	0	0
-10.....		-.5	-.03		-.06	-.08	-.08	0				
-25.....		-1	-.07		-.3	-.2	-.2	-.001	-3			
-50.....		-2	-.1		-.8	-.2	-.4	-.003	-8			
-100, no application.....		-4	-.2		-1	-.4	-.6	-.005	-17			

NORTHEASTERN STATES

TABLE 68.—*Corn grain in the northeastern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Mass.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Nitrogen rate:								
160					70	70		70
120	89		85	83	68	68		80
80	67		75	80	68	68		80
40	44	72	60	74	64	64		70
20	32	71	50	67	58	58		60
10	26	70	46	61	52	52		50
0	20	66	40	55	45	45		50
Average use (cf. table 69)	29	69	45	69	48	65		71
Phosphoric oxide rate:								
160				80	61	61		60
120	66		70	78	59	59		70
80	64	72	66	76	56	56		68
40	58	71	60	74	51	51		60
20	54	70	56	72	48	48		58
10	52	70	52	71	46	46		53
0	50	70	50	70	45	45		50
Average use (cf. table 69)	59	71	57	75	48	54		63
Potash rate:								
160				80	78	78		70
120			70	80	76	76		85
80	66		66	76	72	72		70
40	53	70	59	68	62	62		60
20	42	70	55	60	52	52		58
10	36	69	52	55	46	46		50
0	30	68	50	50	36	35		56
Average use (cf. table 69)	40	69	53	70	47	65		61

TABLE 69.—*Corn grain in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Mass.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Planted acreage.....1,000 acres.....	37	710	1,355	177	143	473	300	3,195
Harvested acreage.....do.....	5	220	1,076	123	142	430	240	2,236
Total production.....1,000 bushels.....	200	9,460	48,958	6,642	5,112	17,200	8,880	96,452
Average yield.....bushels per acre.....	40	43	46	54	36	40	37	43
Do.....percent of potential.....	45	60	54	65	46	51	39	44
Nitrogen:								
Total use.....short tons.....	280	2,662	5,760	2,300	313	10,199	960	22,474
Average use.....pounds per acre.....	15	8	9	26	4	43	6	14
Planted acreage fertilized with N.....percent.....	90	75	85	100	60	75	80	74
Predicted percent change in yield with change in N fertilizer rate								
Change in application rate, percent:								
+200.....	+57	+4	+18	+16	+13	+6	+9	+12
+100.....	+32	+3	+9	+10	+7	+5	+5	+7
+50.....	+15	+2	+4	+6	+4	+4	+3	+4
+25.....	+10	+5	+2	+3	+3	+2	+2	+2
+10.....	+1	+1	+1	+1	+5	.8	.7	+
0, average use.....	0	0	0	0	0	0	0	0
-10.....	-2	-.3	-1	-2	-5	-1	-.7	-.9
-25.....	-9	-.7	-2	-4	-2	-4	-2	-2
-50.....	-16	-2	-5	-8	-3	-9	-4	-5
-100, no application.....	-30	-4	-11	-20	-7	-31	-7	-12
Phosphoric oxide:								
Total use.....short tons.....	840	11,981	17,280	4,600	1,437	14,420	4,200	54,758
Average use.....pounds per acre.....	45	34	26	52	20	61	28	34
Planted acreage fertilized with P ₂ O ₅.....percent.....	90	75	85	100	60	75	80	74
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate								
Change in application rate, percent:								
+200.....	+13	+3	+15	+6	+11	+16	+7	+11
+100.....	+9	+2	+9	+4	+5	+10	+4	+7
+50.....	+5	.7	+5	+2	+3	+6	+2	+4
+25.....	+3	+4	+2	+1	+1	+3	+1	+2
+10.....	+1	+1	+9	.4	+5	+1	.3	+
0, average use.....	0	0	0	0	0	0	0	0
-10.....	-2	-.4	-1	-.5	-1	-1	-.6	-.9
-25.....	-4	-.6	-3	-2	-2	-3	-2	-2
-50.....	-7	-1	-6	-3	-4	-7	-4	-5
-100, no application.....	-16	-2	-12	-8	-7	-13	-8	-9
Potash:								
Total use.....short tons.....	280	2,662	10,368	4,600	832	11,606	1,200	31,548
Average use.....pounds per acre.....	15	8	15	52	12	49	8	20
Planted acreage fertilized with K ₂ O.....percent.....	90	75	85	100	60	75	80	74
Predicted percent change in yield with change in K ₂ O fertilizer rate								
Change in application rate, percent:								
+200.....	+39	+1	+12	+13	+26	+21	+8	+12
+100.....	+25	.8	+6	+10	+14	+15	+6	+7
+50.....	+11	+4	+3	+6	+7	+9	+3	+4
+25.....	+4	+3	+2	+4	+4	+5	+2	+2
+10.....	+2	.07	+9	+2	+1	+2	+1	+1

FERTILIZER USE AND CROP YIELDS

TABLE 70.—*Corn silage in the northeastern region: Estimated average yield (tons per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Maine	N. H.	Vt.	R. I.	Conn.	Weighted average for States reporting
Nitrogen rate:						
160						6
120						6
80	14	13	18	5	5	9
40	12	12	14	16	5	11
20	11	10	12	14	4	9
10	10	10	11	14	4	9
0	9	9	10	12	3	8
Average use (cf. table 71)	11	10	11	15	4	9
Phosphoric oxide rate:						
160						7
120						8
80	12	12	15	16	5	11
40	11	11	12	14	5	10
20	11	10	10	12	5	9
10	10	9	8	11	4	7
0	10	7	6	10	4	6
Average use (cf. table 71)	11	12	10	14	5	9
Potash rate:						
160						8
120						8
80	12	12	20	17	5	14
40	12	12	19	15	5	13
20	12	11	18	14	4	12
10	12	10	18	14	4	12
0	12	9	17	13	3	11
Average use (cf. table 71)	12	12	17	15	4	12

TABLE 71.—*Corn silage in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Maine	N. H.	Vt.	R. I.	Conn.	Weighted average for States reporting
Acreages and yields:						
Planted acreage...1,000 acres	17	11	61	8	45	142
Harvested acreage...do	11	11	64	6	38	130
Total production...1,000 tons	110	110	672	57	418	1,367
Average yield...tons per acre	10	10	10	10	11	10
Do...percent of potential	71	77	50	53	183	93
Nitrogen:						
Total use...short tons	159	100	180	106	225	770
Average use...pounds per acre	19	18	6	26	10	11
Planted acreage fertilized with N...percent	75	90	25	80	50	47
Predicted percent change in yield with change in N fertilizer rate						
Change in application rate, percent:						
+200	+22	+19	+13	+22	+24	+18
+100	+12	+10	+7	+12	+14	+11
+50	+7	+4	+4	+6	+8	+6
+25	+3	+3	+2	+2	+3	+2
+10	+1	+1	+9	+8	+2	+1
0, average use	0	0	0	0	0	0
-2	-2	-9	-8	-2	-3	-2
-10	-4	-3	-2	-3	-5	-3
-25	-8	-5	-4	-7	-11	-7
-50	-16	-18	-8	-15	-19	-14
Phosphoric oxide:						
Total use...short tons	382	400	600	201	450	2,033
Average use...pounds per acre	45	73	20	50	20	29
Planted acreage fertilized with P ₂ O ₅ ...percent	75	90	25	80	50	47
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate						
Change in application rate, percent:						
+200	+10	+36	+35	+7	+23	+23
+100	+4	+7	+20	+26	+5	+13
+50	+3	+5	+12	+14	+3	+8
+25	+1	+2	+7	+7	+2	+4
+10	.6	+1	+2	+3	+.8	+1
0, average use	0	0	0	0	0	0
-10	-.6	-2	-2	-3	-3	-2
-25	-1	-4	-7	-6	-5	-5
-50	-3	-9	-17	-13	-10	-13
-100, no application	-14	-42	-38	-26	-26	-31
Potash:						
Total use	255	225	188	174	225	1,067
Average use...pounds per acre	30	41	6	44	10	14
Planted acreage fertilized with K ₂ O...percent	75	90	25	80	50	47
Predicted percent change in yield with change in K ₂ O fertilizer rate						
Change in application rate, percent:						
+200	+3	+3	+23	+23	+23	+11
+100	+0.04	+3	+2	+13	+16	+7
+50	+.03	+2	+.9	+6	+11	+4
+25	+.002	+2	+.5	+3	+3	+1
+10	.008	+.7	+.2	+2	+1	.6
0, average use	0	0	0	0	0	0
-10	-.009	-1	-.2	-2	-2	-.2
-25	-.017	-4	-.5	-.3	-.5	-.2
-50	-.035	-8	-.9	-.7	-.12	-.5
-100, no application	-.85	-25	-2	-14	-28	-13

TABLE 72.—Wheat in the northeastern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Maine	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Nitrogen rate:								
160								
120								
80								
40	42	42	35	27	15	29	27	34
20	38	38	30	26	12	22	25	29
10	34	34	28	25	8	18	23	24
0	30	30	24	24	6	15	19	23
Average use (cf. table 73)	36	34	28	25	10	20	22	27
Phosphoric oxide rate:								
160								
120								
80								
40	32	32	24	25	11	14	29	24
20	31	32	22	24	10	12	28	22
10	28	28	22	22	9	11	27	21
0	26	25	21	20	8	10	26	20
Average use (cf. table 73)	30	32	24	24	11	15	29	24
Potash rate:								
160								
120								
80								
40	25	25	23	26	16	23	27	24
20	25	25	22	25	13	20	26	22
10	25	25	21	23	11	18	24	21
0	24	24	20	20	9	15	22	20
Average use (cf. table 73)	25	25	22	24	14	22	24	22

TABLE 73.—Wheat in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Maine	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Acreages and yields:								
Planted acreage..... 1,000 acres	2	421	899	78	61	329	90	1,880
Harvested acreage..... do		435	872	78	61	329	66	1,841
Total production..... 1,000 bushels		12,585	18,184	1,677	1,037	6,086	1,221	41,790
Average yield..... bushels per acre		29	22	22	17	18	18	23
Do..... percent of potential		69	63	78	94	62	62	66
Nitrogen:								
Total use..... short tons	14	1,612	3,884	340	392	2,410	262	8,914
Average use..... pounds per acre	14	8	9	9	13	15	6	10
Planted acreage fertilized with N..... percent	45	75	96	70	98	98	83	90
Change in application rate, percent:								
+200	+17	+15	+16	+4	+47	+51	+13	+22
+100	+11	+7	+8	+4	+29	+26	+7	+11
+50	+6	+4	+4	+2	+15	+14	+4	+6
+25	+3	+2	+2	+1	+7	+7	+2	+3
+10	+1	+.7	.9	.4	+2	+2	.6	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	-2	-2	-9	-6	-4	-2	-1	-1
-25	-4	-3	-3	-2	-10	-7	-3	-4
-50	-8	-6	-6	-3	-20	-14	-6	-8
-100, no application.....	-16	-12	-13	-7	-43	-26	-13	-16
Phosphoric oxide:								
Total use..... short tons	14	9,675	15,966	1,020	1,312	9,642	1,500	39,129
Average use..... pounds per acre	14	45	35	26	43	59	33	42
Planted acreage fertilized with P ₂ O ₅ percent	45	75	96	70	98	98	83	90
Change in application rate, percent:								
+200	+9	0	-----	+8	0	+20	+9	+8
+100	+8	0	+4	+6	0	+20	+5	+6
+50	+5	0	+2	+3	0	+17	+3	+4
+25	+2	0	+2	+2	0	+7	+2	+2
+10	+1	0	+1	.6	0	+3	.4	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	-1	0	-1	-1	0	-4	-.9	-1
-25	-3	-.4	-3	-3	-2	-9	-2	-3
-50	-6	-3	-6	-5	-6	-18	-4	-7
-100, no application.....	-14	-23	-14	-18	-30	-37	-10	-20
Potash:								
Total use..... short tons	14	6,375	7,767	680	747	4,820	375	20,778
Average use..... pounds per acre	14	30	17	17	24	29	8	22
Planted acreage fertilized with K ₂ O..... percent	45	75	96	70	98	98	83	90
Change in application rate, percent:								
+200	0	0	+8	+10	+20	+14	+8	+8
+100	0	0	+6	+8	+17	+14	+6	+6
+50	0	0	+3	+4	+11	+9	+3	+4
+25	0	0	+1	+2	+5	+6	+2	+2
+10	0	0	.6	.8	+2	+2	+1	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	0	0	-.6	-1	-3	-2	-.8	-.8

Predicted percent change in yield with change in N fertilizer rate								
+17	+15	+16	+4	+47	+51	+13	+22	
+11	+7	+8	+4	+29	+26	+7	+11	
+6	+4	+4	+2	+15	+14	+4	+6	
+3	+2	+2	+1	+7	+7	+2	+3	
+1	.7	.9	.4	+2	+2	.6	+1	
0	0	0	0	0	0	0	0	
-2	-2	-9	-6	-4	-2	-1	-1	
-4	-3	-3	-2	-10	-7	-3	-4	
-8	-6	-6	-3	-20	-14	-6	-8	
-16	-12	-13	-7	-43	-26	-13	-16	

Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate								
+9	0	-----	+8	0	+20	+9	+8	
+8	0	+4	+6	0	+20	+5	+6	
+5	0	+2	+3	0	+17	+3	+4	
+2	0	+2	+2	0	+7	+2	+2	
+1	0	+1	.6	0	+3	.4	+1	
0	0	0	0	0	0	0	0	
-1	0	-1	-1	0	-4	-.9	-1	
-3	-.4	-3	-3	-2	-9	-2	-3	
-6	-3	-6	-5	-6	-18	-4	-7	
-14	-23	-14	-18	-30	-37	-10	-20	

Predicted percent change in yield with change in K ₂ O fertilizer rate								
+200	0	0	+8	+10	+20	+14	+8	+8
+100	0	0	+6	+8	+17	+14	+6	+6
+50	0	0	+3	+4	+11	+9	+3	+4
+25	0	0	+1	+2	+5	+6	+2	+2
+10	0	0	.6	.8	+2	+2	+1	+1
0, average use.....	0	0	0	0	0	0	0	0
-10	0	0	-.6	-1	-3	-2	-.8	-.8

TABLE 74.—*Rye in the northeastern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Conn. ¹	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Nitrogen rate:								
160								
120								
80								
40	72							
40	64	42	35	27	33			40
20	52	38	30	26	25	29	27	36
10	45	34	28	25	20	22	25	32
0	36	30	24	23	16	18	22	29
Average use (cf. table 75)	42	33	27	25	12	15	19	26
Phosphoric oxide rate:								
160								
120								
80								
40	67		25	26				
40	58	32	25	25	27	18		25
20	50	31	22	24	24	17		26
10	46	28	22	22	23	13	29	28
0	40	26	22	20	22	12	28	27
Average use (cf. table 75)	47	32	24	23	23	10	26	29
Potash rate:								
160								
120								
80								
40	66							
40	64		24	27				66
20	57	25	23	26	30	23	29	27
10	51	25	22	25	28	20	28	26
0	49	25	21	23	25	18	26	24
Average use (cf. table 75)	47	24	22	22	25	15	26	22

¹ Oats and rye.

TABLE 75.—*Rye in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Change in application rate, percent:

TABLE 76.—Barley in the northeastern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Maine	Vt.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Nitrogen rate:									
160									
120									
80		55							36
40	52	52	52	44	33	25	42		44
20	47	46	47	38	32	20	32	26	37
10	42	42	42	34	31	16	27	24	33
0	38	37	38	30	29	12	22	22	29
Average use (cf. table 77)	42	40	41	34	31	16	28	23	33
Phosphoric oxide rate:									
160						35		33	
120						34		32	
80					31	33		30	
40	41	40	41	30	31	24	24	37	31
20	40	37	40	28	29	23	20	35	25
10	36	35	36	27	28	23	18	34	23
0	32	31	31	26	25	22	15	32	21
Average use (cf. table 77)	35	34	41	30	31	24	26	36	32
Potash rate:									
160		54							
120		54							54
80		54		30	34		35		54
40	31	54	31	29	33	30	32	28	27
20	31	54	31	28	31	28	29	26	25
10	31	52	31	26	29	25	26	24	24
0	30	50	30	25	25	22	22	21	22
Average use (cf. table 77)	31	52	31	27	28	28	30	24	24

TABLE 77.—Barley in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Maine	Vt.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Acreages and yields:									
Planted acreage..... 1,000 acres	2	2	80	127	16	12	89	16	344
Harvested acreage..... do	6	1	75	159	16	12	89	14	372
Total production..... 1,000 bushels	210	27	2,550	5,644	512	348	2,759	392	12,442
Average yield..... bushels per acre	35	27	34	35	32	29	31	28	33
Do..... percent of potential	67	49	65	80	91	88	74	76	76
Nitrogen:									
Total use..... short tons	8	4	240	491	78	71	587	42	1,521
Average use..... pounds per acre	8	4	6	8	10	12	13	5	9
Planted acreage fertilized with N..... percent	25	10	75	86	90	95	90	75	84
Predicted percent change in yield with change in N fertilizer rate									
+200	+15	+10	+13	+16	+6	+46	+46	+8	+23
+100	+8	+5	+7	+8	+4	+23	+24	+4	+12
+50	+4	+3	+2	+4	+3	+11	+11	+2	+5
+25	+2	+2	+1	+2	+2	+5	+6	+2	+3
+10	.7	.7	.7	.9	.6	.2	.3	.8	.1
0, average use	.0	.0	.0	.0	.0	.0	.0	.0	0
-10	-.8	-.5	-.7	-.1	-.8	-.2	-.3	-.1	-.1
-25	-.2	-.2	-.2	-.3	-.2	-.6	-.6	-.3	-.4
-50	-.5	-.3	-.4	-.5	-.3	-.12	-.12	-.4	-.7
-100, no application	-10	-5	-9	-12	-8	-30	-24	-6	-15
Phosphoric oxide:									
Total use..... short tons	8	7	1,800	2,617	234	251	2,348	240	6,905
Average use..... pounds per acre	8	8	45	32	29	42	53	30	40
Planted acreage fertilized with P ₂ O ₅ percent	25	10	75	86	90	95	90	75	84
Predicted percent change in yield with change in P₂O₅ fertilizer rate									
+200	+12	+11	0	+6	+9	-----	+29	+6	+11
+100	+6	+6	0	+4	+5	+6	+23	+8	+8
+50	+4	+3	0	+3	+4	+3	+14	+3	+5
+25	+2	+2	0	+2	+2	+2	+8	+2	+3
+10	.8	.8	0	.9	.1	.3	+3	.7	.1
0, average use	0	0	0	0	0	0	0	0	0
-10	-.9	-.9	0	-.1	-.1	-.7	-.4	-.7	-.2
-25	-.3	-.2	-.8	-.3	-.2	-.3	-.9	-.2	-.4
-50	-.6	-.4	-.3	-.6	-.6	-.4	-.18	-.4	-.8
-100, no application	-10	-8	-22	-13	-18	-6	-42	-10	-22
Potash:									
Total use..... short tons	8	5	600	981	52	127	1,174	60	3,007
Average use..... pounds per acre	8	6	15	15	6	21	26	8	17
Planted acreage fertilized with K ₂ O..... percent	25	10	75	86	90	95	90	75	84
Predicted percent change in yield with change in K₂O fertilizer rate									
+200	+0.7	+3	0	+9	+10	+20	+17	+12	+9
+100	+.7	+2	0	+6	+5	+12	+12	+8	+6
+50	+.6	+1	0	+3	+2	+7	+7	+3	+4
+25	+.5	+.3	0	+1	+.4	+4	+4	+2	+2
+10	+.2	+.09	0	+.4	+.2	+1	+2	+.8	+.7
0, average use	0	0	0	0	0	0	0	0	0
-10	-.2	-.2	0	-.5	-.4	-.1	-.2	-.1	-.2

Change in application rate, percent:

+200	+0.7	+3	0	+9	+10	+20	+17	+12	+9
+100	+.7	+2	0	+6	+5	+12	+12	+8	+6
+50	+.6	+1	0	+3	+2	+7	+7	+3	+4
+25	+.5	+.3	0	+1	+.4	+4	+4	+2	+2
+10	+.2	+.09	0	+.4	+.2	+1	+2	+.8	+.7
0, average use	0	0	0	0	0	0	0	0	0
-10	-.2	-.2	0	-.5	-.4	-.1	-.2	-.1	-.2

TABLE 78.—*Oats in the northeastern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Maine	N. H.	Vt.	Mass.	R. I.	Conn. ¹	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Nitrogen rate:													
160													
120													
80													
40													
20													
10													
0													
Average use (cf. table 79).	64	33	32			49	79	44	24	16	16	28	40
Phosphoric oxide rate:													
160													
120													
80													
40													
20													
10													
0													
Average use (cf. table 79).	60	20	20	35	35	70	60	15	22	22	30	45	38
Potash rate:													
160													
120													
80													
40													
20													
10													
0													
Average use (cf. table 79).	60	35	35	36	36	78	36	30	22	22	30	45	35

¹ Oats and rye (nurse crop).

TABLE 79.—Oats in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N , P_2O_5 , and K_2O , 1950 basis

Acresages, yields, and fertilizer use		Maine	N. H.	Vt.	Mass.	R. I.	Conn. ¹	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Acresages and yields:														
Planted acreage..... 1,000 acres		107	12	22	6	4	40	850	855	52	6	55	70	2,079
Harvested acreage..... do		98	5	37	7	1	5	787	788	43	8	55	55	1,889
Total production..... 1,000 bushels		4,802	210	1,295	231	33	190	33,841	29,944	1,677	224	1,870	1,568	75,885
Average yield..... bushels per acre		49	42	35	33	33	38	43	38	39	28	34	28	40
Do..... percent of potential		64	93	78	82	60	30	57	83	118	85	72	47	70
Nitrogen:														
Total use..... short tons		481	54	25	-----	36	200	2,550	2,736	294	28	244	150	6,798
Average use..... pounds per acre		9	9	2	-----	18	10	6	6	11	9	9	4	6
Planted acreage fertilized with N..... percent		30	60	10	-----	60	50	75	80	95	92	65	71	74
Predicted percent change in yield with change in N fertilizer rate														
Change in application rate, percent:														
+200.....		+14	+14	+4	-----	+13	+29	+12	+24	+45	+40	+19	+14	+18
+100.....		+6	+8	+2	-----	+9	+16	+6	+13	+23	+22	+10	+7	+10
+50.....		+3	+4	+1	-----	+5	+8	+3	+7	+12	+11	+5	+4	+5
+25.....		+2	+2	+.6	-----	+2	+4	+2	+4	+5	+5	+2	+3	+3
+10.....		+1	+1	+.1	-----	+1	+1	.7	+1	+2	+2	+.9	+1	0
0, average use.....		.5	+.8	+.1	-----	0	0	0	0	0	0	0	0	.9
-10.....		0	0	0	0	0	0	0	0	0	0	0	0	0
-25.....		-.5	-.8	-.2	-----	-2	-2	-1	-2	-2	-2	-.2	-.9	-1
-50.....		-2	-2	-.6	-----	-4	-4	-2	-5	-5	-5	-2	-3	-3
-100, no application.....		-3	-4	-1	-----	-9	-8	-5	-9	-12	-11	-5	-6	-7
		-6	-8	-2	-----	-19	-21	-9	-16	-29	-26	-12	-12	-12
Phosphoric oxide:														
Total use..... short tons		321	144	50	216	72	1,500	15,300	11,628	882	98	876	1,000	32,087
Average use..... pounds per acre		6	24	4	72	36	75	36	27	34	33	35	29	31
Planted acreage fertilized with P ₂ O ₅ percent		30	60	10	90	60	50	75	80	95	92	65	71	74
Predicted percent change in yield with change in P₂O₅ fertilizer rate														
Change in application rate, percent:														
+200.....		+1	+24	+28	-----	+3	-----	-----	+47	+10	+9	+14	+16	+37
+100.....		.7	+16	+15	-----	+2	-----	-----	+29	+5	+5	+8	+12	+14
+50.....		+4	+10	+8	-----	+1	+1	+5	+16	+2	+2	+4	+6	+8
+25.....		+2	+5	+4	-----	+.4	+.6	+4	+2	+8	+1	+2	+3	+4
+10.....		+1	+1	+2	-----	+1	+1	+2	+3	+3	+.6	+.5	+1	+2
0, average use.....		0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....		-.1	-3	-2	-----	-.2	-.6	-2	-.3	-.5	-.6	-1	-2	-2
-25.....		-.3	-7	-4	-----	-.9	-2	-5	-4	-8	-1	-3	-4	-5
-50.....		-.4	-17	-9	-----	-2	-3	-14	-8	-18	-2	-2	-5	-6
-100, no application.....		-.8	-44	-17	-----	-12	-10	-40	-18	-42	-5	-5	-13	-27
Katosh:														
Total use..... short tons		321	162	60	-----	72	700	6,375	6,156	196	57	488	250	14,837
Average use..... pounds per acre		6	27	6	-----	36	35	15	14	8	19	18	7	14
Planted acreage fertilized with K ₂ O..... percent		30	60	10	-----	60	50	75	80	95	92	65	71	74
Predicted percent change in yield with change in K₂O fertilizer rate														
Change in application rate, percent:														
+200.....		1	10	5	-----	17	10	4	10	12	10	16	16	18

TABLE 80.—Buckwheat and soybeans in the northeastern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Buckwheat	Soybeans					Weighted average for States reporting
	Pa.	N. Y.	Pa.	N. J.	Del.	Md.	
Nitrogen rate:							
160							
120							
80							
40	35						
20	30						
10	28				9		9
0	24				5		5
Average use (cf. table 81)	25				5		5
Phosphoric oxide rate:							
160							
120							
80							
40	25	25	25	25	26	26	26
20	25	23	23	23	24	24	24
10	22	20	20	20	19	20	20
0	22	14	14	14	14	16	15
Average use (cf. table 81)	24	18	21	23	13	23	20
Potash rate:							
160							
120							
80							
40	24	23	23	23	23	24	23
20	23	21	21	21	22	22	22
10	22	18	18	18	19	19	18
0	21	16	16	16	16	15	16
Average use (cf. table 81)	20	12	12	12	10	8	10
	21	15	17	21	13	22	18

TABLE 81.—Buckwheat and soybeans in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Buckwheat	Soybeans					Weighted average for States reporting
	Pa.	N. Y.	Pa.	N. J.	Del.	Md.	
Acreages and yields:							
Planted acreage..... 1,000 acres.....	93	6	46	29	45	76	202
Harvested acreage..... do.....	81	6	17	14	46	41	124
Total production..... 1,000 bushels.....	1,620	108	289	266	644	656	1,963
Average yield..... bushels per acre.....	20	18	17	19	14	16	16
Do..... percent of potential.....	57	72	68	76	54	62	62
Nitrogen:							
Total use..... short tons.....	88	22	130		24		176
Average use..... pounds per acre.....	2	7	5		1		4
Planted acreage fertilized with N..... percent.....	95	75	80		20		52
Predicted percent change in yield with change in N fertilizer rate							
Change in application rate, percent:							
+200	+6					+15	
+100	+3					+8	
+50	+2					+3	
+25	+.8					+2	
+10	+.3					+.4	
0, average use.....	0	0	0	0	0	0	0
-10	-.4					-1	-1
-25	-1					-2	-2
-50	-2					-4	-4
-100, no application.....	-4					-35	-35
Phosphoric oxide:							
Total use..... short tons.....	1,496	45	555	576	200	1,312	2,688
Average use..... pounds per acre.....	32	15	24	40	9	34	27
Planted acreage fertilized with P ₂ O ₅ percent.....	95	75	80	90	20	70	64
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate							
Change in application rate, percent:							
+200	+6	+40	+20	+9	+64	+11	+25
+100	+4	+29	+15	+7	+38	+9	+17
+50	+3	+20	+10	+6	+9	+7	+8
+25	+2	+13	+6	+4	+7	+4	+5
+10	+1	+6	+3	+2	+6	+1	+3
0, average use.....	0	0	0	0	0	0	0
-10	-1	-6	-4	-2	-6	-3	-4
-25	-3	-15	-9	-6	-11	-6	-12
-50	-6	-30	-28	-16	-25	-15	-21
-100, no application.....	-13	-71	-76	-78	-43	-35	-53
Potash:							
Total use..... short tons.....	220	22	333	576	93	1,312	2,336
Average use..... pounds per acre.....	5	7	14	40	4	34	23
Planted acreage fertilized with K ₂ O..... percent.....	95	75	80	90	20	70	64
Predicted percent change in yield with change in K ₂ O fertilizer rate							
Change in application rate, percent:							
+200	+4	+23	+26	+11	+29	+10	+18
+100	+2	+13	+15	+7	+18	+8	+12
+50	+1	+6	+9	+5	+8	+4	+6
+25	.7	+3	+5	+4	+6	+2	+4
+10	.3	+2	+2	+2	+2	.7	+2
0, average use.....	0	0	0	0	0	0	0

TABLE 82.—Tobacco in the northeastern region: Estimated average yield (pounds per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Mass.	Conn.	Pa.	Md.	W. Va.	Weighted average for States reporting
Nitrogen rate:						
160	1,685	1,930	1,930			1,900
120	1,575	1,800	1,800			1,773
80	1,425	1,580	1,580			1,392
40	1,075	1,280	1,280	1,158	1,590	1,180
20	805	1,050	1,050	1,062	1,502	991
10	650	975	975	812	1,415	896
0	500	800	800	700	1,375	752
Average use (cf. table 83)	1,750	2,001	1,265	1,065	1,465	1,336
Phosphoric oxide rate:						
160	1,640	1,650	1,650	1,188	1,555	1,453
120	1,515	1,560	1,560	1,163	1,542	1,390
80	1,475	1,425	1,425	1,125	1,530	1,306
40	1,250	1,249	1,249	1,075	1,517	1,183
20	1,000	1,070	1,070	1,040	1,505	1,064
10	725	950	950	1,025	1,502	980
0	600	850	850	1,000	1,500	913
Average use (cf. table 83)	1,490	1,510	1,400	1,113	1,520	1,306
Potash rate:						
160	1,595	1,599	1,599	1,125	1,599	1,402
120	1,575	1,590	1,590	1,125	1,590	1,394
80	1,545	1,545	1,545	1,099	1,500	1,358
40	1,440	1,450	1,450	1,006	1,454	1,263
20	1,320	1,360	1,360	919	1,380	1,172
10	1,225	1,300	1,300	861	1,360	1,112
0	1,100	1,240	1,240	800	1,300	1,047
Average use (cf. table 83)	1,580	1,590	1,590	1,120	1,454	1,388

TABLE 83.—Tobacco in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Mass.	Conn.	Pa.	Md.	W. Va.	Weighted average for States reporting
Acreages and yields:						
Planted acreage.....1,000 acres.....8		19	39	50	3	119
Harvested acreage.....do.....8		19	40	50	3	120
Total production.....1,000 pounds.....13,675		27,412	61,365	40,000	3,379	145,831
Average yield.....pounds per acre.....1,709		1,443	1,534	800	1,126	1,215
Do.....percent of potential.....98		72	79	67	70	74
Nitrogen:						
Total use.....short tons.....820		1,900	741	1,056	40	4,557
Average use.....pounds per acre.....200		200	38	42	25	76
Planted acreage fertilized with N.....percent.....100		100	100	98	100	99
Predicted percent change in yield with change in N fertilizer rate						
Change in application rate, percent:						
+200			+44	+12	+8	
+100			+24	+9	+5	
+50			+12	+5	+2	+7
+25			+6	+3	+1	+4
+10			+2	+1	.5	+1
0, average use		0	0	0	0	0
-10		-2	-2	-2	-7	-2
-25		-6	-6	-4	-1	-6
-50		-16	-15	-12	-3	-14
-100, no application		-60	-36	-34	-6	-41
Phosphoric oxide:						
Total use.....short tons.....410		1,000	1,462	1,760	80	4,712
Average use.....pounds per acre.....100		105	75	70	50	79
Planted acreage fertilized with P ₂ O ₅.....percent.....100		100	100	98	100	99
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate						
Change in application rate, percent:						
+200		+19	+25	+8	+2	+16
+100		+16	+17	+6	+1	+12
+50		+10	+10	+3	.6	+7
+25		+6	+5	+1	.3	+3
+10		+2	+2	+1	.1	+1
0, average use		0	0	0	0	0
-10		-2	-2	-1	.2	-1
-25		-6	-6	-2	.3	-4
-50		-14	-15	-4	.7	-10
-100, no application		-44	-39	-10	-1	-28
Potash:						
Total use.....short tons.....820		1,900	2,340	2,640	64	7,764
Average use.....pounds per acre.....200		200	120	106	40	130
Planted acreage fertilized with K ₂ O.....percent.....100		96	100	98	100	98
Predicted percent change in yield with change in K ₂ O fertilizer rate						
Change in application rate, percent:						
+200				+0.7	+9	+1
+100				+.6	+7	+1
+50				+.6	+4	+3
+25				+.5	+2	+1
+10				.2	.7	.4
0, average use		0	0	0	0	0
-10		.3	-.6	-.3	-1	-.4

TABLE 84.—*Potatoes in the northeastern region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Maine	N. H.	Vt.	Mass.	R. I.	Conn.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Nitrogen rate:													
160	580	500	491	560	452	565	452	455	455	461	452	—	494
120	565	477	473	500	426	500	438	436	428	438	438	376	472
80	525	418	413	390	377	394	411	415	389	388	382	335	435
40	415	338	334	280	299	285	374	379	312	316	315	265	368
20	360	290	290	240	250	235	350	360	227	272	268	215	328
10	330	275	270	210	226	201	338	340	177	238	238	189	303
0	300	250	250	180	200	178	325	326	100	210	205	157	277
Average use (cf. table 85)	560	437	383	415	450	508	402	403	387	370	443	212	439
Phosphoric oxide rate:													
160	580	480	459	500	453	499	426	463	442	418	418	392	479
120	575	412	414	465	438	475	426	438	425	400	400	372	466
80	515	353	352	385	381	400	401	412	390	363	363	333	427
40	450	297	289	300	300	311	362	375	357	315	312	286	378
20	400	262	260	250	250	256	338	350	327	271	276	250	344
10	375	246	243	230	226	230	325	338	317	250	255	227	327
0	350	225	225	200	200	200	310	325	300	227	227	200	307
Average use (cf. table 85)	590	475	424	505	465	500	426	450	439	412	404	276	474
Potash rate:													
160	585	449	475	495	451	498	427	457	443	414	415	391	479
120	580	437	431	445	419	450	425	449	429	382	386	368	469
80	530	380	383	350	352	355	403	436	400	355	357	328	435
40	465	320	328	260	290	265	371	413	348	312	312	287	390
20	435	280	291	210	255	220	349	393	275	279	286	258	360
10	420	270	275	200	244	199	338	387	223	267	268	238	344
0	400	250	250	172	225	175	325	375	150	250	250	218	323
Average use (cf. table 85)	585	461	445	500	447	500	427	454	440	393	400	275	473

TABLE 85.—*Potatoes in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Maine	N. H.	Vt.	Mass.	R. I.	Conn.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Acreages and yields:													
Planted acreage	1,000 acres	5	6	13	5	8	130	100	44	5	13	18	472
Harvested acreage	do	4	6	13	5	12	113	95	44	4	13	18	457
Total production	1,000 bushels	61,750	980	1,092	2,816	1,275	3,481	34,315	18,525	12,980	628	1,664	1,980 141,486
Average yield	bushels per acre	475	245	182	215	255	290	304	195	295	157	129	110 310
Do	percent of potential	81	49	37	38	56	51	67	43	65	34	28	28 61
Nitrogen:													
Total use	short tons	7,094	207	206	580	360	500	4,631	3,185	1,700	153	819	160 19,595
Average use	pounds per acre	114	90	64	88	150	125	71	64	77	68	128	18 83
Planted acreage fertilized with N	percent	100	100	85	100	100	100	95	98	100	95	98	88 97
Predicted percent change in yield with change in N fertilizer rate													
+200	+14	+26	+40	+9	+16	+7	+6	+10	+20	+19	+21	+21	+16
+100	+14	+15	+25	-9	+10	+3	+3	+7	+13	+14	+14	+9	+14
+50	+4	+12	+15	+25	+9	+16	+7	+6	+13	+14	+14	+5	+8
+25	+2	+7	+8	+13	0	+10	+3	+7	+7	+7	+2	+5	+4
+10	+10	+3	+3	+5	+1	+4	+1	+1	+3	+3	+1	+3	+1
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-2	-4	-3	-6	-2	-5	-2	-1	-3	-4	-2	-2	-2
-25	-4	-10	-8	-14	-6	-15	-4	-3	-8	-9	-7	-6	-5
-50	-18	-21	-16	-28	-18	-32	-9	-10	-20	-18	-18	-14	-14
-100, no application	-46	-42	-34	-56	-57	-68	-20	-19	-74	-45	-54	-27	-36
Phosphoric oxide:													
Total use	short tons	13,135	414	412	1,160	600	700	9,262	6,860	3,400	329	819	320 36,811
Average use	pounds per acre	210	180	129	177	250	175	142	137	154	146	128	36 156
Planted acreage fertilized with P ₂ O ₅	percent	100	100	85	100	100	100	95	98	100	95	98	88 97
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate													
+200	0	0	0	0	0	0	0	0	0	0	0	0	+31 +18
+100	+15	0	0	0	0	0	0	+2	+2	+2	+4	+9	+11
+50	+4	+13	0	0	0	0	0	+2	+1	+2	+3	+5	+1
+25	+4	+8	0	0	0	0	0	+1	+9	+1	+2	+2	+5
+10	0	+2	+4	0	0	0	0	+1	+1	+2	+2	+2	+0
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-3	-3	-4	-5	-4	-5	-2	-1	-1	-2	-2	-2	-7
-25	-2	-10	-11	-4	-1	-3	-8	-4	-4	-5	-6	-6	-3
-50	-7	-22	-22	-20	-6	-17	-8	-11	-10	-15	-15	-12	-10
-100, no application	-40	-53	-47	-61	-57	-60	-27	-28	-32	-45	-43	-27	-34
Potash:													
Total use	short tons	17,470	414	412	1,160	600	800	9,262	7,105	3,400	300	819	280 42,022
Average use	pounds per acre	280	180	129	177	250	200	142	142	154	130	128	31 178
Planted acreage fertilized with K ₂ O	percent	100	100	85	100	100	100	95	98	100	95	98	88 97
Predicted percent change in yield with change in K ₂ O fertilizer rate													
+200	0	0	0	0	0	0	0	+0.2	+0.8	+2	+4	+5	+1
+100	+11	0	0	0	0	0	0	+2	+8	+1	+2	+4	+8
+50	+10	0	0	0	0	0	0	+0.2	+0.8	+1	+2	+4	+2
+25	-6	+2	+7	0	-17	0	+2	+6	+1	+2	+4	+4	+1
+10	-9	+1	+3	0	-2	0	+1.1	+3	+8	+9	+2	+2	+2
0, average use	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	+3	-2	-4	-1	+2	0	-0.5	-0.8	-2	-1	-3	-2	-2
-25	+1	-7	-9	-8	+2	-2	-2	-2	-3	-2	-7	-5	-2
-50	+3	-23	-19	-26	-4	-19	-7	-5	-10	-4	-16	-9	-6

TABLE 86.—*Vegetables in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acres, yields, and fertilizer use	Maine	N. H.	Vt.	Mass.	R. I.	Conn.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Acresages and yields:													
Planted acreage.....1,000 acres.....	34	11	3	40	5	25	276	89	168	48	121	3	823
Harvested acreage.....do.....	18	.6	.7	3		.2	237	89	158	40	110	.2	657
Total production.....1,000 tons.....	35	2	2	15		.6	1,369	399	664	95	416	2	3,000
Average yield.....tons per acre.....	2	3	3	5		3	6	4	4	2	4	10	4
Do.....percent of potential.....													
Nitrogen:													
Total use.....short tons.....	759	165	48	1,000	144	1,250	12,305	2,740	6,015	759	2,860	35	28,080
Average use.....pounds per acre.....	45	30	32	50	64	100	89	62	72	32	47	23	68
Planted acreage fertilized with N.....percent.....	82	100	71	100	100	100	100	100	100	98	94	100	98
Predicted percent change in yield with change in N fertilizer rate													
Change in application rate, percent:													
+200.....		+27			+12					+25	+33	+35	+30
+100.....		+18	+34	+32	+12	+10			+6	+19	+28	+25	+17
+50.....		+8	+10	+20	+18	+8	+23	+16	+5	+12	+19	+16	+16
+25.....		+5	+6	+10	+9	+5	+12	+8	+3	+6	+9	+9	+8
+10.....		+2	+2	+4	+4	+2	+5	+3	+1	+2	+4	+4	+3
0, average use.....		0	0	0	0	0	0	0	0	0	0	0	0
-10.....		-2	-3	-5	-5	-2	-3	-5	-3	-4	-4	-4	-4
-25.....		-7	-8	-13	-14	-7	-7	-14	-10	-6	-8	-12	-9
-50.....		-16	-17	-28	-28	-17	-15	-31	-24	-15	-18	-25	-24
-100, no application.....		-55	-52	-75	-71	-71	-42	-70	-64	-80	-58	-62	-66
Phosphoric oxide:													
Total use.....short tons.....	1,197	550	96	1,600	338	2,188	23,615	4,505	12,030	2,006	4,918	60	53,103
Average use.....pounds per acre.....	70	100	64	80	150	175	171	101	143	84	81	40	129
Planted acreage fertilized with P ₂ O ₅.....percent.....	82	100	71	100	100	100	100	100	100	98	94	100	98
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate													
Change in application rate, percent:													
+200.....			+18							+15	+21	+30	+20
+100.....		+11	+29	+16					+14		+10	+12	+18
+50.....		+9	+18	+10	+7		+25	+10			+5	+8	+5
+25.....		+9	+5	+10	+6	+5	+0.3	+12	+6	+3	+5	+9	+5
+10.....		+4	+2	+4	+2	+2	+3	+5	+2	+2	+3	+4	+3
0, average use.....		0	0	0	0	0	0	0	0	0	0	0	0
-10.....		-4	-3	-5	-4	-3	-6	-6	-3	-2	-3	-4	-4
-25.....		-11	-8	-13	-11	-9	-4	-15	-9	-7	-9	-8	-11
-50.....		-25	-23	-29	-27	-22	-12	-35	-21	-20	-27	-22	-25
-100, no application.....		-78	-85	-88	-84	-100	-69	-78	-87	-93	-84	-90	-75
Potash:													
Total use.....short tons.....	1,056	400	96	1,400	338	1,875	11,806	3,721	12,030	2,008	3,261	52	38,043
Average use.....pounds per acre.....	62	73	64	70	150	150	86	84	143	84	54	35	92
Planted acreage fertilized with K ₂ O.....percent.....	82	100	71	100	100	100	100	100	100	98	94	100	98
Predicted percent change in yield with change in K ₂ O fertilizer rate													
Change in application rate, percent:													
+200.....		+29		+18	+29			+53	+22		+10	+43	+41
+100.....		+24		+18	+21			+53	+22		+10	+34	+29
+50.....		+14	+15	+12	+13	+4	+5	+29	+16		+12	+20	+16
+25.....		+7	+9	+8	+8	+3	+2	+14	+10	+5	+7	+10	+9
+10.....		+3	+4	+4	+3	+1	+8	+6	+4	+3	+3	+4	+4
0, average use.....		0	0	0	0	0	0	0	0	0	0	0	0
-10.....		-4	-3	-3	-4	-2	-2	-7	-4	-4	-4	-5	-5
-25.....		-10	-9	-10	-11	-8	-6	-16	-12	-10	-10	-12	-12
-50.....		-21	-22	-24	-23	-20	-15	-32	-25	-26	-23	-25	-27
100, no application.....		-57	-69	-69	-69	-90	-75	-68	-73	-95	-71	-66	-63

TABLE 87.—*Fruits in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Maine	N. H.	Vt.	Mass.	R. I.	Conn.	N. Y.	Pa.	Del.	Md.	W. Va.	Weighted average for States reporting
Acreages and yields:												
Planted acreage.....	40	10	7	35	4	17	290	175	5	37	20	640
Harvested acreage.....												
Total production.....												
Average yield.....												
Do.....												
Nitrogen:												
Total use.....	545	75	30	450	64	240	3,262	1,060	91	491	197	6,495
Average use.....	27	15	9	26	32	29	22	12	36	26	20	20
Planted acreage fertilized with N.....	71	50	24	70	80	80	90	60	96	31	53	73
Change in application rate, percent:												
+200.....	+21	+21	+16	+22	+21	+22	+22	+19	+21	+21	+75	+23
+100.....	+13	+12	+9	+14	+13	+14	+13	+11	+13	+12	+44	+13
+50.....	+7	+6	+4	+8	+8	+8	+8	+6	+8	+7	+22	+8
+25.....	+5	+4	+2	+5	+4	+4	+4	+3	+4	+4	+8	+4
+10.....	+2	+2	+2	+2	+2	+2	+2	+8	+2	+2	+3	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-2	-2	-1	-2	-2	-2	-2	-1	-2	-2	-6	-2
-25.....	-5	-4	-3	-5	-5	-5	-4	-3	-6	-4	-14	-4
-50.....	-9	-7	-6	-10	-11	-10	-10	-7	-11	-8	-25	-9
-100, no application.....	-27	-20	-16	-27	-30	-28	-25	-18	-31	-26	-50	-24
Phosphoric oxide:												
Total use.....	282	15	30	88	216	120	1,044	525	75	535	255	3,185
Average use.....	14	3	9	5	108	14	7	6	30	29	25	10
Planted acreage fertilized with P ₂ O ₅	71	50	24	70	80	80	90	60	96	31	53	73
Change in application rate, percent:												
+200.....	+2	+2	+2	+2	0	+2	+2	+3	+0.8	+2	+65	+4
+100.....	+2	+1	+2	+1	0	+2	+1	+2	+8	+1	+55	+3
+50.....	+.8	+.9	+.7	+1	0	+1	+.9	+1	+7	+8	+31	+2
+25.....	+.6	+.6	+.4	+.6	0	+.6	+.6	+.6	+5	+4	+14	+1
+10.....	+.1	+.3	+1	+.3	0	+.3	+.3	+.3	+2	+08	+5	+4
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-.1	-.3	-.2	-.3	0	-.3	-.3	-.3	-.2	-.2	-7	-.5
-25.....	-.7	-.6	-.5	-.6	0	-.6	-.6	-.6	-.5	-.6	-14	-.1
-50.....	-1	-1	-2	-1	0	-2	-2	-2	-2	-1	-28	-3
-100, no application.....	-5	-2	-4	-3	-7	-5	-4	-3	-6	-5	-57	-5
Potash:												
Total use.....	282	20	30	88	148	91	1,305	420	50	283	85	2,802
Average use.....	14	4	9	5	74	11	9	5	20	15	8	9
Planted acreage fertilized with K ₂ O.....	71	50	24	70	80	76	90	60	96	31	53	73
Change in application rate, percent:												
+200.....	+4	+4	+5	+4	0	+5	+5	+4	+4	+4	+65	+6
+100.....	+3	+2	+3	+3	0	+4	+3	+2	+3	+3	+35	+4
+50.....	+2	+1	+1	+2	0	+2	+1	+9	+2	+2	+17	+2
+25.....	+1	+1	+1	+1	0	+1	+6	+6	+9	+1	+7	+0
+10.....	+.3	+.3	+.3	+.3	0	+.6	+.3	+.3	+5	+5	+4	+4
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-.6	-.3	-.3	-.3	0	-.6	-.6	-.6	-.5	-.5	-4	-.7
-25.....	-.2	-.9	-.9	-.9	-.3	-.1	-.1	-.1	-.9	-.9	-9	-1
-50.....	-3	-2	-2	-2	-1	-2	-2	-2	-3	-2	-17	-2
-100, no application.....	-9	-4	-6	-4	-13	-7	-7	-5	-7	-7	-35	-7

FERTILIZER USE AND CROP YIELDS

TABLE 88.—*Dry beans and peas in the northeastern region: Estimated average yield (pounds per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Maine	Vt.	N. Y. ¹	Weighted average for States reporting
Nitrogen rate:				
160				
120				
80	2,245			2,245
40	2,212	1,860	1,860	1,877
20	2,125	1,464	1,464	1,495
10	2,075	1,050	1,050	1,099
0	2,000	640	540	609
Average use (cf. table 89)	2,175	1,122	945	1,004
Phosphoric oxide rate:				
160				
120				
80	2,300			2,300
40	2,187	1,590	1,590	1,618
20	2,050	1,086	1,086	1,132
10	1,935	828	828	880
0	1,825	585	585	644
Average use (cf. table 89)	2,237	1,248	960	1,028
Potash rate:				
160				
120	2,337			2,337
80	2,337			2,337
40	2,187	1,845	1,845	1,861
20	2,100	1,458	1,458	1,488
10	2,060	1,200	1,200	1,241
0	2,000	900	900	952
Average use (cf. table 89)	2,187	1,638	1,125	1,177

¹ Does not include dry peas.

TABLE 89.—*Dry beans and peas in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Maine	Vt.	N. Y. ¹	Weighted average for States reporting
Acreages and yields:				
Planted acreage..... 1,000 acres	8	0.7	160	168.7
Harvested acreage..... do	5	.7	131	136.7
Total production..... 1,000,000 pounds	4	.5	135	139.5
Average yield..... pounds per acre	800	714	1,030	1,020
Do..... percent of potential	34	38	55	54
Nitrogen:				
Total use..... short tons	120	4	600	724
Average use..... pounds per acre	30	11	8	8
Planted acreage fertilized with N..... percent	100	50	75	76
Predicted percent change in yield with change in N fertilizer rate				
Change in application rate, percent:				
+200	+54	+82	+59	
+100	+34	+38	+36	
+50	+20	+21	+20	
+25	+13	+10	+10	
+10	+5	+3	+3	
0, average use	0	0	0	0
-10	-6	-3	-3	-3
-25	-16	-10	-10	-10
-50	-30	-21	-21	-20
-100, no application	-52	-43	-41	-41
Phosphoric oxide:				
Total use..... short tons	200	9	1,200	1,409
Average use..... pounds per acre	50	26	15	17
Planted acreage fertilized with P ₂ O ₅ , percent	100	50	75	76
Predicted percent change in yield with change in P₂O₅ fertilizer rate				
Change in application rate, percent:				
+200	+48	+78	+78	
+100	+26	+39	+37	
+50	+12	+19	+18	
+25	+5	+11	+10	
+10	+5	+5	+5	
0, average use	0	0	0	0
-10	-8	-5	-5	-5
-25	-12	-11	-11	-11
-50	-28	-20	-19	-19
-100, no application	-53	-39	-38	-38
Potash:				
Total use..... short tons	160	10	600	770
Average use..... pounds per acre	40	29	8	9
Planted acreage fertilized with K ₂ O, percent	100	50	75	76
Predicted percent change in yield with change in K₂O fertilizer rate				
Change in application rate, percent:				
+200	+40	+35	+34	
+100	+28	+19	+18	
+50	+16	+9	+9	
+25	+8	+4	+4	
+10	+4	+1	+1	
0, average use	0	0	0	0
-10	-3	-1	-1	-1
-25	-9	-4	-4	-4
-50	-18	-8	-8	-8
-100, no application	-45	-20	-20	-20

¹ Does not include dried peas.

TABLE 90.—*Improved legume-grass hay and pasture in the northeastern region: Estimated average yield (tons per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Maine	N. H.	Vt.	Mass.	R. I.	Conn.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Nitrogen rate:													
160													
120													3.5
80	1.9						3.5	1.9		1.7			2.9
40	1.7		3.5		3.8		3.5	1.7		1.5			2.8
20	1.6		4.0		3.8		3.4	1.6		1.2			2.7
10	1.5		3.6		3.8		3.2	1.6		1.0			2.5
0	1.4		3.5		2.8		3.1	1.4		.9			2.4
Average use (cf. table 91)	1.4		3.5		3.2		3.1	1.2		.8			2.5
Phosphoric oxide rate:													
160	3.5												
120	3.4												2.8
80	3.2	3.8	3.5	3.4		3.6	3.5	1.8	3.4		1.9		2.9
40	2.8	3.2	3.2	2.9	3.7	2.9	3.4	1.2	3.1	1.6	1.6	2.2	2.6
20	2.5	2.9	3.0	2.5	3.6	2.4	3.3	1.0	2.8	1.5	1.5	2.1	2.4
10	2.3	2.7	2.9	2.2	3.4	2.2	3.2	.9	2.4	1.4	1.4	2.0	2.3
0	2.0	2.5	2.8	2.0	3.0	2.0	3.1	.8	2.1	1.4	1.4	2.0	2.2
Average use (cf. table 91)	2.2	2.7	2.8	2.5	3.4	2.3	3.1	.8	2.2	1.4	1.6	2.0	2.2
Potash rate:													
160	3.2												3.5
120	3.2												2.9
80	2.9												2.8
40	2.6	3.8	3.9	2.7	1.5	2.7	3.5	1.7	3.1	1.6	1.4	2.3	2.6
20	2.3	3.0	3.0	2.4	.9	2.4	3.4	1.6	2.5	1.3	1.2	2.1	2.5
10	2.2	2.7	2.4	2.2	.6	2.2	3.3	1.4	2.1	1.1	1.1	1.9	2.4
0	2.0	2.3	1.5	2.0	.3	2.0	3.2	1.2	1.8	.9	1.0	1.6	2.1
Average use (cf. table 91)	2.1	2.4	1.7	2.2	.5	2.1	3.2	1.3	1.9	1.0	1.4	1.7	2.2

TABLE 91.—*Improved legume-grass hay and pasture in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Maine	N. H.	Vt.	Mass.	R. I.	Conn.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Acreages and yields:													
Planted acreage..... 1,000 acres.....	300	350	991	392	36	187	3,775	2,434	290	68	472	1,000	10,295
Harvested acreage..... do.....	890	357	1,019	374	37	287	3,848	2,468	260	69	472	820	10,901
Total production..... 1,000 tons.....	788	410	1,397	590	56	481	6,100	3,641	467	96	644	1,050	15,720
Average yield..... tons per acre.....	.9	1.1	1.4	1.5	1.5	1.7	1.6	1.5	1.8	1.4	1.4	1.3	1.4
Do..... percent of potential.....	26	29	39	42	39	47	46	71	41	67	67	56	50
Nitrogen:													
Total use..... short tons.....	400	280	165	915	63	360	377	767	-----	29	2,802	200	6,358
Average use..... pounds per acre.....	3	2	.3	5	4	4	.2	.6	-----	.8	12	.4	1
Planted acreage fertilized with N..... percent.....	10	20	33	29	25	20	4	9	-----	15	30	20	13
Change in application rate, percent:													
+200	+2	+0.7	+15	+15	+0.2	+2	+2	+3	+3	+1	+1	+1	+1
+100	+1	+4	+11	+11	+1	+9	+1	+1	+1	+1	+1	+1	+1
+50	+6	+2	+6	+6	+07	+4	+07	+1	+1	+1	+1	+1	+1
+25	+3	+1	+3	+3	+03	+3	+03	+1	+1	+1	+1	+1	+1
+10	+1	+06	+2	+2	+02	+06	+02	+1	+1	+1	+1	+1	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.1	-.06	-2	-2	-.02	-.1	-.02	-.1	-.1	-.2	-.2	-.2	-.06
-25	-.4	-.1	-3	-3	-.03	-.3	-.03	-.3	-.3	-.4	-.4	-.4	-.2
-50	-.6	-.2	-6	-6	-.04	-.5	-.04	-.5	-.5	-.8	-.8	-.8	-.3
-100, no application.....	-1	-.5	-14	-14	-.06	-1	-.06	-1	-.1	-2	-2	-2	-.5
Phosphoric oxide:													
Total use..... short tons.....	1,200	1,575	4,125	3,989	207	1,100	4,530	4,390	644	178	10,507	3,000	35,445
Average use..... pounds per acre.....	8	9	8	20	12	12	2	4	4	5	44	6	7
Planted acreage fertilized with P ₂ O ₅ percent.....	10	20	33	29	25	18	4	9	8	15	30	20	13
Change in application rate, percent:													
+200	+15	+12	+7	+29	+8	+23	+1	+13	+12	+7	+27	+4	+8
+100	+7	+6	+16	+6	+12	+6	+6	+7	+7	+3	+19	+2	+5
+50	+5	+3	+2	+9	+4	+6	+3	+3	+3	+1	+11	+1	+2
+25	+2	+1	+1	+4	+1	+3	+1	+1	+2	+1	+6	+7	+1
+10	+1	.4	+4	+2	.7	+9	.03	.5	.6	+3	+3	+3	.5
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.2	-.6	-.5	-.2	-.7	-1	-.06	-.6	-.8	-.4	-.3	-.7	-.6
-25	-.3	-.2	-1	-5	-.2	-3	-.2	-.2	-.2	-.8	-.6	-.1	-.1
-50	-.5	-.3	-2	-9	-.6	-3	-.3	-.4	-.4	-.2	-.14	-.2	-.3
-100, no application.....	-11	-8	-4	-19	-12	-12	-.6	-7	-9	-4	-31	-3	-6
Potash:													
Total use..... short tons.....	800	525	1,650	2,260	128	480	1,510	2,190	644	118	9,106	1,000	20,411
Average use..... pounds per acre.....	5	3	3	12	7	5	.8	2	4	4	39	2	4
Planted acreage fertilized with K ₂ O..... percent.....	10	20	33	29	25	20	4	9	8	15	30	20	13
Change in application rate, percent:													
+200	+8	+11	+35	+16	+84	+9	+0.4	+5	+17	+12	+23	+9	+9
+100	+4	+6	+18	+9	+43	+4	+2	+3	+9	+7	+15	+5	+5
+50	+2	+5	+12	+4	+22	+2	+1	+1	+5	+4	+8	+2	+3
+25	+1	+3	+6	+2	+10	+1	+08	+6	+2	+2	+4	+1	+1
+10	+1	.4	+3	+8	+4	+5	.05	.3	+1	+1	+2	+1	.6
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.4	-.6	-1	-1	-.5	-.5	-.04	-.3	-.1	-.1	-.2	-.6	-.5
-25	-.1	-.2	-4	-3	-12	-1	-.09	-.6	-.3	-.2	-.5	-.1	-.1
-50	-.2	-.1	0	0	0	0	0	0	0	0	0	0	0
-100, no application.....	-1	-.2	-.4	-.3	-.12	-.1	-.09	-.6	-.3	-.2	-.5	-.1	-.1
Predicted percent change in yield with change in N fertilizer rate													
+200	+2	+0.7	+15	+15	+0.2	+2	+2	+3	+3	+1	+1	+1	+1
+100	+1	+4	+11	+11	+1	+9	+1	+1	+1	+1	+1	+1	+1
+50	+6	+2	+6	+6	+07	+4	+07	+1	+1	+1	+1	+1	+1
+25	+3	+1	+3	+3	+03	+3	+03	+1	+1	+1	+1	+1	+1
+10	+1	.4	+2	+2	+02	+06	+02	+1	+1	+1	+1	+1	+1
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.2	-.6	-1	-1	-.2	-.2	-.06	-.2	-.1	-.1	-.2	-.3	-.2
-25	-.3	-.2	-1	-5	-.2	-.3	-.2	-.2	-.2	-.8	-.6	-.1	-.1
-50	-.5	-.3	-2	-9	-.6	-.3	-.3	-.4	-.4	-.2	-.14	-.2	-.3
-100, no application.....	-1	-.2	-.4	-.3	-.12	-.1	-.09	-.6	-.3	-.2	-.5	-.1	-.1
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate													
+200	+8	+11	+35	+16	+84	+9	+0.4	+5	+17	+12	+23	+9	+9
+100	+4	+6	+18	+9	+43	+4	+2	+3	+9	+7	+15	+5	+5
+50	+2	+5	+12	+4	+22	+2	+1	+1	+5	+4	+8	+2	+3
+25	+1	+3	+6	+2	+10	+1	+08	+6	+2	+2	+4	+1	+1
+10	+1	.4	+3	+8	+4	+5	.05	.3	+1	+1	+2	+1	.6
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.4	-.6	-1	-1	-.5	-.5	-.04	-.3	-.1	-.1	-.2	-.6	-.5
-25	-.1	-.2	-4	-3	-12	-1	-.09	-.6	-.3	-.2	-.5	-.1	-.1
-50	-.2	-.1	0	0	0	0	0	0	0	0	0	0	0
-100, no application.....	-1	-.2	-.4	-.3	-.12	-.1	-.09	-.6	-.3	-.2	-.5	-.1	-.1
Predicted percent change in yield with change in K ₂ O fertilizer rate													
+200	+8	+11	+35	+16	+84	+9	+0.4	+5	+17	+12	+23	+9	+9
+100	+4	+6	+18	+9	+43	+4	+2	+3	+9	+7	+15	+5	+5
+50	+2	+5	+12	+4	+22	+2	+1	+1	+5	+4	+8	+2	+3
+25	+1	+3	+6	+2	+10	+1	+08	+6	+2	+2	+4	+1	+1
+10	+1	.4	+3	+8	+4	+5	.05	.3	+1	+1	+2	+1	.6
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10	-.4	-.6	-1	-1	-.5	-.5	-.04	-.3	-.1	-.1	-.2	-.6	-.5
-25	-.1	-.2	-4	-3	-12	-1	-.09	-.6	-.3	-.2	-.5	-.1	-.1
-50	-.2	-.1	0	0	0	0	0	0	0	0	0	0	0
-100, no application.....	-1	-.2	-.4	-.3	-.12	-.1	-.09	-.6	-.3	-.2	-.5	-.1	-.1

FERTILIZER USE AND CROP YIELDS

TABLE 92.—Permanent grass hay and pasture in the northeastern region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Maine	N. H.	Vt.	Mass.	R. I.	Conn.	N. Y.	Pa.	N. J.	Del.	Md.	W. Va.	Weighted average for States reporting
Acreages and yields:													
Planted acreage..... 1,000 acres..	623	200	1,973	400	46	266	2,500	2,300	307	60	993	3,200	12,868
Harvested acreage..... do.....													
Total production..... 1,000 tons													
Average yield..... tons per acre													
Do..... percent of potential													
Nitrogen:													
Total use..... short tons	765	60	295	50	48	30	150	690	130	50		19	2,287
Average use..... pounds per acre	.2	.6	.3	.2	.2	.2	.12	.6	.8	.2		.01	12.4
Planted acreage fertilized with N..... percent	50	20	20	15	10	4	12	17	20	20		5	
Predicted percent change in yield with change in N fertilizer rate													
Change in application rate, percent:													
+200.....	+2	+1	+7	+2	+14	+1	+1	+2	+0.6	+4		+0.02	+2
+100.....	+1	+7	+5	+9	+7	+7	+8	+1	+3	+2		.01	+1
+50.....	+.5	+4	+2	+6	+4	+3	+6	+5	+1	+7		.005	.6
+25.....	+3	+2	+1	+3	+2	+1	+4	+2	+0.7	+3		.002	.3
+10.....	+1	+1	+5	+1	+7	+0.4	+2	+1	+0.3	+1		.0005	.2
0, average use.....	0	0	0	0	0	0	0	0	0	0		0	0
-10.....	-.1	-.1	-.1	-.1	-.7	-.1	-.2	-.1	-.03	-.2		-.001	-.1
-25.....	-.3	-.2	-.5	-.3	-.2	-.2	-.2	-.2	-.07	-.4		-.002	-.6
-50.....	-.5	-.3	-.2	-.6	-.4	-.4	-.3	-.4	-.1	-.8		-.004	-.1
-100, no application.....	-1	-.8	-2	-1	-.7	-.8	-.5	-1	-.3	-2		-.008	-2
Phosphoric oxide:													
Total use..... short tons	1,770	900	4,530	160	158	300	4,000	9,660	1,560	271	7,151	3,000	33,460
Average use..... pounds per acre	6	9	4	.8	7	3	8	10	9	9	14	2	5
Planted acreage fertilized with P ₂ O ₅ percent	50	20	20	2	15	10	4	12	17	20	20	5	12
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate													
Change in application rate, percent:													
+200.....	+5	+5	+19	+2	+10	+3	+2	+22	+9	+16	+22	+4	+11
+100.....	+3	+3	+10	+9	+5	+2	+1	+12	+5	+8	+11	+1	+5
+50.....	+1	+1	+5	+4	+3	+8	+5	+6	+3	+3	+5	+.6	+3
+25.....	.9	+7	+3	+2	+2	+4	+3	+3	+2	+1	+3	+2	+1
+10.....	+10	+3	+6	+0.07	+6	+2	+1	+1	+5.5	+4	+1	+0.09	+4.4
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-.4	-.3	-.2	-.1	-.0	-.2	-.2	-.2	-.5	-.6	-.1	-.2	-.9
-25.....	-.9	-.9	-.3	-.2	-.2	-.5	-.4	-.4	-.2	-.2	-.3	-.4	-.2
-50.....	-2	-2	-5	-.4	-.4	-.9	-.8	-.7	-.4	-.4	-.7	-.8	-.3
-100, no application.....	-5	-3	-11	-1	-9	-2	-1	-15	-.8	-.9	-14	-1	-6
Potash:													
Total use..... short tons	1,530	300	1,970	100	99	75	1,000	1,380	1,560	161	3,576	300	12,051
Average use..... pounds per acre	5	3	2	.5	4	.6	.8	1	10	5	7	.2	2
Planted acreage fertilized with K ₂ O..... percent	50	20	20	2	15	10	4	12	17	20	20	5	12
Predicted percent change in yield with change in K ₂ O fertilizer rate													
Change in application rate, percent:													
+200.....	+6	+3	+2	+4	+85	+3	+0.6	+4	+52	+18	+21	+0.2	+5
+100.....	+3	+1	+9	+1	+52	+1	+3	+2	+28	+10	+13	+1	+3
+50.....	+2	+7	+4	+7	+36	+6	+1	+1	+14	+5	+8	+0.6	+2
+25.....	.8	+3	+2	+3	+12	+3	+0.8	+5	+7	+3	+5	+.03	.8
+10.....	+4	+1	+0.07	+1	+6	+0.05	+0.04	+1	+3	+1	+2	+0.02	+3
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-.4	-.2	-.1	-.2	-.6	-.1	-.06	-.2	-.3	-.1	-.1	-.02	-.3
-25.....	-.8	-.4	-.2	-.5	-.9	-.3	-.1	-.5	-.7	-.3	-.3	-.03	-.7
-50.....	-2	-.7	-.4	-.9	-12	-.9	-.2	-.1	-14	-.5	-.6	-.06	-.1
-100, no application.....	-4	-2	-.8	-2	-18	-2	-.3	-2	-29	-15	-16	-.1	-3

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TABLE 93.—*Corn grain in the western region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Wash.	Oreg.	Idaho	Colo.	Utah ¹	Nev.	Calif.	Ariz.	N. Mex.	Weighted average for States reporting
Nitrogen rate:										
160	103	65	68					107		
120	101	66	65		20.0	50	98	50	50	90
80	95	60	56	48	18.5	46	80	46	46	68
40	78	47	44	41	17.5	38	60	38	38	53
20	69	39	37	33	17.0	34	49	34	34	44
10	64	35	32	29	16.5	32	43	32	32	36
0	60	39	27	24	16.0	28	35	28	28	27
Average use (cf. table 94)	67	39	31	24	16.0	28	48	28	28	30
Phosphoric oxide rate:										
160		64	60							62
120	102	65	57			44		44	44	52
80	102	66	51		20.1	41		41	41	50
40	96	65	41	48	20.0	36	105	36	36	54
20	90	63	35	46	19.9	32	99	32	32	50
10	88	62	31	45	19.8	30	94	30	30	48
0	85	62	27	43	19.7	28	90	28	28	46
Average use (cf. table 94)	90	62	35	44	19.7	34	91	28	28	47
Potash rate:										
160										
120										
80										
40								105		105
20								105		105
10								105		105
0								105		105
Average use (cf. table 94)								105		105

¹ Corn silage shown in tons; not included in averages for western region.

TABLE 94.—Corn grain in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N , P_2O_5 , and K_2O . 1950 basis

Average application rate of N, P ₂ O ₅ , and K ₂ O, 1955 basis											
Acresages, yields, and fertilizer use	Wash.	Oreg.	Idaho	Colo.	Utah ¹	Nev.	Calif.	Ariz.	N. Mex.	Weighted average for States reporting	
Acresages and yields:											
Planted acreage.....	1,000 acres	17	28	34	2,399	25	2	86	39	118	723
Harvested acreage.....	do	6	26	16	371	18		42	27	76	564
Total production.....	1,000 bushels	360	2,975	752	8,533	162		1,596	310	1,102	13,628
Average yield.....	bushels per acre	60	38	47	23	9		38	11	14	24
Do.....	percent of potential	58	58	69	48	45		36	22	28	44
Nitrogen:											
Total use.....	short tons	127	280	140	230	3	2	790	40	24	1,633
Average use.....	pounds per acre	15	20	8	1	.2	2	18	2	.4	4
Planted acreage fertilized with N.....	percent	30	40	47	10	1		29	4	1	14
Predicted percent change in yield with change in N fertilizer rate											
Change in application rate, percent:											
+200.....		+39	+22	+5	+0.06	+6	+42	+7	+1	+11	
+100.....		+20	+12	+1	+.03	+3	+22	+3	.7	+5	
+50.....		+7	+6	.4	.02	+2	+11	+2	.4	+2	
+25.....		+5	+3	.2	.01	.8	+7	.9	.2	+1	
+10.....		+3	+2	.08	.003	.4	+2	.4	.09	.5	
0, average use.....		0	0	0	0	0	0	0	0	0	
-10.....		-.8	-2	-2	-.08	-.004	-.4	-2	-.4	-.09	
-25.....		-3	-3	-.2	-.01	-.9	-7	-.9	-.2	-1	
-50.....		-4	-11	-7	-.2	-.02	-2	-12	-2	-.4	
-100, no application.....		-10	-24	-15	-.4	-.04	-3	-27	-4	-.8	
Phosphoric oxide:											
Total use.....	short tons	153	224	320	402	5	32	146	16	24	1,317
Average use.....	pounds per acre	18	16	19	2	.4	30	3	.8	.4	4
Planted acreage fertilized with P ₂ O ₅	percent	30	40	47	10	1	15	7	1	11	
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate											
Change in application rate, percent:											
+200.....		+9	+4	+30	+3	+0.1	+23	+3	+1	+0.8	
+100.....		+6	+3	+16	+2	.04	+14	+2	.7	.4	
+50.....		+3	+1	+9	.4	.02	+7	.9	.4	.2	
+25.....		+2	.3	+4	.1	.01	+4	.4	.2	.09	
+10.....		+.6	.2	+1	+.05	.004	+1	.2	.09	.03	
0, average use.....		0	0	0	0	0	0	0	0	0	
-10.....		-.7	-.08	-2	-.1	-.006	-2	-.3	-.1	-.06	
-25.....		-2	-.2	-6	-.3	-.01	-4	-.4	-.2	-.1	
-50.....		-3	-.3	-12	-.4	-.03	-9	-.8	-.4	-.2	
-100, no application.....		-6	-2	-24	-.6	-.05	-20	-2	-.8	-.4	
Potash:											
Total use.....	short tons	64	28	40				24			156
Average use.....	pounds per acre	9	2	2				.6			2
Planted acreage fertilized with K ₂ O.....	percent	30	40	47				2			21

Predicted percent change in yield with change in K₂O fertilizer rate

TABLE 95.—*Wheat in the western region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Wash.	Oreg.	Idaho	Mont.	Colo.	Utah	Nev.	Calf.	Ariz.	Weighted average for States reporting
Nitrogen rate:										
160										
120										
80										
40	30	32	29	21	22	25	29	29	24	2
20	28	28	27	21	20	18	28	28	18	2
10	24	25	26	20	19	16	26	26	12	2
0	20	21	23	17	17	16	24	24	8	1
Average use, (cf. table 96)	20	21	23	17	17	16	26	26	14	1
Phosphoric oxide rate:										
160										
120										
80										
40				19						
20			27	19			24	28	25	2
10			27	19			22	27	25	2
0			27	18			21	26	24	2
Average use (cf. table 96)			27	16			20	24	24	1
Potash rate:										
160										
120										
80										
40										
20										
10										
0										
Average use, (cf. table 96)			27	16			21	25	24	1

TABLE 96.—Wheat in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N , P_2O_5 , and K_2O , 1950 basis.

Predicted percent change in yield with change in K₂O fertilizer rate

TABLE 97.—*Barley in the western region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

TABLE 98.—Barley in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P_2O_5 , and K₂O, 1950 basis

Application rates of N, P ₂ O ₅ , and K ₂ O, 1955 data										
Acreages, yields, and fertilizer use	Wash.	Oreg.	Idaho	Mont.	Colo.	Nev.	Calif.	Ariz.	Weighted average for States reporting	
Acreages and yields:										
Planted acreage.....	1,000 acres	278	1,398	410	900	1,822	25	2,300	198	5,331
Harvested acreage.....	do	250	1,337	386	849	490	30	1,800	163	4,305
Total production.....	1,000 bushels	8,750	10,784	13,896	23,772	9,555	1,050	57,600	6,520	131,927
Average yield.....	bushels per acre	35	32	36	28	20	35	32	40	31
Do.....	percent of potential	65	71	72	88	50	47	89	54	78
Nitrogen:										
Total use.....	short tons	83	1,359	156	55	60	20	9,030	1,800	12,563
Average use.....	pounds per acre	.6	7	.8	.12	.1	2	8	18	5
Planted acreage fertilized with N.....	percent	2	20	4	1	2	9	19	30	12
Predicted percent change in yield with change in N fertilizer rate										
Change in application rate, percent:										
+200.....	+2	+19	+0.8	+0.2	+0.2	+2	+8	+18	+6	
+100.....	+2	+12	+0.6	+.1	+1	+1	+5	+10	+4	
+50.....	+1	+7	+0.3	+0.07	+0.06	+4	+3	+5	+2	
+25.....	+1	+1	+0.3	+0.03	+0.04	+2	+1	+2	+1.6	
+10.....	+2	+6	+0.3	+0.01	+0.02	+0.08	+5	+1	+3	
0, average use.....	0	0	0	0	0	0	0	0	0	
-10.....	-5	-3	-0.3	-0.01	-0.02	-2	-5	-1	-5	
-25.....	-1	-5	-0.6	-0.03	-0.04	-3	-1	-2	-1	
-50.....	-2	-11	-0.8	-0.06	-0.06	-5	-3	-5	-2	
-100, no application.....	-2	-17	-1	-0.1	-0.1	-1	-5	-10	-4	
Phosphoric oxide:										
Total use.....	short tons		260	110	106	59	2,334	600	3,460	
Average use.....	pounds per acre		1	.2	.3	5	2	6	1	
Planted acreage fertilized with P ₂ O ₅	percent		4	1	2	9	8	30	6	
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate										
Change in application rate, percent:										
+200.....		+1	+0.5	+0.8	+0.5	+2	+0.7	+1	+6	
+100.....		.5	.2	.5	.3	.9	.3	.2	.3	
+50.....		.4	.1	.3	.1	.4	.2	.1	.3	
+25.....		.3	.06	.2	.1	.2	.1	.1	.2	
+10.....		.1	.02	.1	.04	.06	.05	.05	.05	
0, average use.....	0	0	0	0	0	0	0	0	0	
-10.....		0	-0.02	-0.1	-0.06	-1	-0.06	-0.06	-0	
-25.....		.05	-0.06	-0.2	-0.1	-3	-0.3	-0.2	-0.2	
-50.....		.1	-0.1	-0.2	-0.3	-5	-3	-3	-3	
-100, no application.....		.3	-0.2	-0.3	-0.5	-1	-0.6	-0.6	-0.6	

Potash: Total

Total use..... short tons..... 37 137 174
 Average use..... pounds per acre..... 3 .1 1
 Planted acreage fertilized with K₂O..... percent..... 9 1 1

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TABLE 99.—*Oats in the western region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

TABLE 100.—*Oats in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

TABLE 101.—*Sorghum grain, rice, peanuts, and flaxseed in the western region: Estimated average yield from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Sorghum grain (bushels per acre)			Rice (bags per acre)	Peanuts (pounds per acre)	Flaxseed (bushels per acre)			
	Calif.	Ariz.	Weighted average for States reporting	Calif.	N. Mex.	Oreg.	Calif.	Ariz.	Weighted average for States reporting
Nitrogen rate:									
160									
120									
80		78	78				28	28	28
40	68	65	60	46			24	24	24
20	52	63	56	43			22	22	22
10	48	54	50	39			21	21	21
0	45	52	47	36			20	20	20
Average use (cf. table 102)	48	55	50	44			20	24	24
Phosphoric oxide rate:									
160									
120									
80		75	75		875	28	28	28	28
40	60	52	57	43	870	24	24	24	24
20	58	41	52	43	829	22	22	22	22
10	56	36	49	43	759	21	21	21	21
0	53	30	45	42	650	20	20	20	20
Average use (cf. table 102)	54	34	47	42	762	20	24	23	24
Potash rate:									
160									
120									
80									
40	60		60						
20	60		60						
10	60		60						
0	60		60						
Average use (cf. table 102)	60		60						

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TABLE 102.—Sorghum grain, rice, peanuts, and flaxseed in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acresages, yields, and fertilizer use	Sorghum grain			Rice	Peanuts	Flaxseed			
	Calif.	Ariz.	Weighted average for States reporting	Calif.	N. Mex.	Oreg.	Calif.	Ariz.	Weighted average for States reporting
Acresages and yields:									
Planted acreage.....	1,000 acres								
Harvested acreage, 1,000 acres:									
Grain.....	142	72	214	250		7	2	60	14
Silage.....	136	86	222						
Forage.....	4	9	13						
Sirup.....	2	5	7						
Total.....	142	100	242	232		7	2	59	13
Total production:									
Grain.....	5,304	3,784	9,088						
Silage.....	40	90	130						
Forage.....	7	10	17						
Sirup.....									
Rice.....									
Peanuts.....									
Flaxseed.....									
Average yield:									
Grain.....	bushels per acre	39	44	41					
Silage.....	tons per acre	10	10	10					
Forage.....	do	4	2	2					
Sirup.....	gallons per acre								
Rice.....	bags per acre			34					
Peanuts.....	pounds per acre				935				
Flaxseed.....	bushels per acre					8	24	19	23
Average yield.....	percent of potential	65	56	62	74	107	24	86	68
Nitrogen:									
Total use.....	short tons	618	450	1,068	3,830		3	1,332	300
Average use.....	pounds per acre	9	12	10	31		3	44	43
Planted acreage fertilized with N.....	percent	23	25	24	77		10	88	85
Predicted percent change in yield with change in N fertilizer rate									
Change in application rate, percent:									
+200.....	+13	+15	+14				+3		
+100.....	+8	+7	+8	+5			+2	+18	+18
+50.....	+4	+5	+4	+3			+.7	+9	+9
+25.....	+2	+2	+2	+2			+2	+4	+4
+10.....	+1	+2	+1	+.3			+.2	+2	+2
0, average use.....	.6	+2	+1	+.3		0	0	0	0
-10.....	0	0	0	0		0	-.2	-2	-2
-25.....	-.6	-.7	-.6	-.1			-5	-4	-5
-50.....	-1	-2	-1	-3			-10	-9	-10
-100, no application.....	-3	-3	-3	-7			-19	-18	-18
Phosphoric oxide:									
Total use.....	short tons	305	270	575	15		32	1	1,282
Average use.....	pounds per acre	4	8	5	.1		9	1	240
Planted acreage fertilized with P ₂ O ₅	percent	8	25	14	.3		21	10	34
Potash:									
Total use.....	short tons	233		233	.5				1,523
Average use.....	pounds of acre	3		3	.004				40
Planted acreage fertilized with K ₂ O.....	percent	6		6	.01				84
Predicted percent change in yield with change in K ₂ O fertilizer rate									
Change in application rate, percent:									
+200.....	0		0						
+100.....	0		0						
+50.....	0		0						
+25.....	0		0						
+10.....	0		0						
0, average use.....	0	0	0	0		0	0	0	0
-10.....	0		0						
-25.....	0		0						
-50.....	0		0						
-100, no application.....	0		0						

TABLE 103.—*Lint cotton, mint, and hops in the western region: Estimated average yield (pounds per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Lint cotton			Mint			Hops				
	Calif.	Ariz.	N. Mex.	Weighted average for States reporting	Wash.	Oreg.	Weighted average for States reporting	Wash.	Oreg.	Calif.	Weighted average for States reporting
Nitrogen rate:											
160	963		1,104	997				2,050	1,475	2,050	1,810
120	945		1,045	969	63	53	56	2,050	1,383	2,050	1,770
80	910	1,181	964	994	62	49	52	2,000	1,263	2,000	1,700
40	858	1,020	800	889	57	42	46	1,850	1,143	1,850	1,580
20	816	934	683	823	38	38	38	1,670	1,050	1,670	1,410
10	784	909	605	784	30	36	34	1,580	1,000	1,580	1,340
0	744	893	500	739	20	34	30	1,500	900	1,500	1,250
Average use (cf. table 104)	886	1,125	635	902	61	44	48	1,760	1,100	1,860	1,510
Phosphoric oxide rate:											
160	962	1,093		1,003					1,500		1,500
120	962	1,085	1,115	1,021	100		100		1,475		1,475
80	945	998	1,090	984	96		96	2,025	1,440	2,025	1,780
40	910	875	985	914	88	44	56	1,995	1,390	1,995	1,740
20	833	796	900	835	70	43	50	1,942	1,350	1,942	1,700
10	798	752	860	788	61	43	48	1,920	1,325	1,920	1,678
0	744	700	800	743	51	42	44	1,900	1,300	1,900	1,656
Average use (cf. table 104)	802	798	849	809	61	44	48	1,920	1,375	1,942	1,704
Potash rate:											
160	901			901							
120	901			901							
80	901			901							
40	901			901							
20	901			901							
10	901			901							
0	901			901							
Average use (cf. table 104)	901			901							

TABLE 104.—*Lint cotton, mint, and hops in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Lint cotton				Mint			Hops			
	Calif.	Ariz.	N. Mex.	Weighted average for States reporting	Wash.	Oreg.	Weighted average for States reporting	Wash.	Oreg.	Calif.	Weighted average for States reporting
Acreages and yields:											
Planted acreage.....	1,000 acres	600	273	189	1,062	5	14	19	14	15	8
Harvested acreage.....	do	581	275	170	1,026	5	15	20	14	15	9
Total production.....	1,000,000 pounds	489	237	94	820						38
Do.....	1,000 pounds					306	657	963	24,081	16,279	56,481
Average yield.....	pounds per acre	842	862	550	799	61	44	48	1,720	1,085	1,486
Do.....	percent of potential	87	73	49	77	61	83	78	84	72	80
Nitrogen:											
Total use.....	short tons	16,383	9,000	1,323	26,706	150	342	492	210	225	172
Average use.....	pounds per acre	55	66	14	50	60	48	52	30	30	43
Planted acreage fertilized with N.....	percent	78	73	20	66						607
Change in application rate, percent:	Predicted percent change in yield with change in N fertilizer rate										
+200.....		+27	+13	+23	+23	+14	+18	+10	+10	+10	+15
+100.....		+16	+9	+15	+12	+10	+10	+8	+8	+8	+10
+50.....		+8	+6	+2	+9	+7	+6	+5	+4	+4	+5
+25.....		+4	+4	+9	+5	+4	+4	+2	+2	+2	+3
+10.....		+2	+1	+5	+2	+1	+2	+2	+2	+2	+1
0, average use.....		0	0	0	0	0	0	0	0	0	0
-10.....		-2	-2	-1	-7	-2	-2	-2	-2	-2	-2
-25.....		-5	-5	-6	-3	-6	-5	-4	-3	-5	-4
-50.....		-8	-8	-21	-11	-14	-8	-6	-10	-8	-8
-100, no application.....		-21	-21	-18	-67	-21	-33	-15	-18	-19	-17
Phosphoric oxide:											
Total use.....	short tons	3,614	3,200	832	7,646	25	274	299	70	225	82
Average use.....	pounds per acre	12	23	9	14	10	38	31	10	30	20
Planted acreage fertilized with P ₂ O ₅	percent	20	73	20	34						377
Change in application rate, percent:	Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate										
+200.....		+20	+10	+13	+30	+10	+15	+2	+5	+3	+3
+100.....		+12	+6	+8	+14	+5	+7	+1	+2	+2	+2
+50.....		+6	+3	+4	+7	+3	+4	+6	+2	+1	+1
+25.....		+3	+2	+2	+3	+1	+2	+3	+1	+5	+1
+10.....		+1	+1	+8	+1	+6	+7	+1	+4	+2	+1
0, average use.....		0	0	0	0	0	0	0	0	0	0
-10.....		-1	-7	-8	-2	-7	-1	-2	-4	-3	-1
-25.....		-3	-1	-2	-4	-2	-2	-4	-1	-8	-1
-50.....		-6	-3	-4	-8	-3	-4	-7	-4	-1	-2
-100, no application.....		-12	-6	-8	-17	-5	-8	-1	-5	-2	-3
Potash:											
Total use.....	short tons	158			158		140	140		30	33
Average use.....	pounds per acre	.5			.5		20	20		4	8
Planted acreage fertilized with K ₂ O.....	percent	4			4						.4

Change in application rate, percent:

+200
+100
+50
+25
+10
0, average use:
-10
-25

FERTILIZER USE AND CROP YIELDS

TABLE 105.—Sugar beets in the western region: Estimated average yield (tons per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis

Average fertilizer rates (pounds per acre)	Wash.	Oreg.	Idaho	Mont.	Wyo.	Colo.	Utah	Calif.	Ariz.	N. Mex.	Weighted average for States reporting
Nitrogen rate:											
160	29	25						25	25		25
120	28	25		15		18		24	24		21
80	26	24		14		18		23	23	15	20
40	20	23	19	14		17	14	20	20	14	18
20	15	22	18	13		16	13	18	18	13	17
10	12	22	18	13		15	13	17	17	13	16
0	10	21	18	12		14	13	16	16	12	15
Average use (cf. table 106)	20	24	18	14		15	14	23	25	14	19
Phosphoric oxide rate:											
160											22
120											21
80	27										
40	26	21	19	16	16	17	17	25	25		17
20	25	21	18	16	15	16	16	25	25	16	20
10	22	21	18	15	13	15	15	24	24	15	19
0	22	21	18	15	12	15	15	24	24	15	19
Average use (cf. table 106)	20	21	18	14	10	14	15	24	24	15	18
Potash rate:											
160											25
120											23
80											23
40											23
20											23
10											23
0											23
Average use (cf. table 106)	25	21	19	16	15	15	16	24	25	16	19

TABLE 106.—Sugar beets in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis

Acreages, yields, and fertilizer use	Wash.	Oreg.	Idaho	Mont.	Wyo.	Colo.	Utah	Calif.	Ariz.	N. Mex.	Weighted average for States reporting
Acreages and yields:											
Planted acreage..... 1,000 acres	21	26	97	65	38	1,154	39	219	4	2	665
Harvested acreage..... do	14	16	87	62	36	1,146	38	209	.5	.2	609
Total production..... 1,000 tons	295	341	1,511	744	454	2,190	535	3,898	8	2	9,978
Average yield..... tons per acre	21	21	17	12	13	15	14	19	16	10	16
Do..... percent of potential	72	84	89	75	81	83	82	76	64	59	62
Nitrogen:											
Total use..... short tons	420	683	960	1,300		355	600	9,460	380	32	14,190
Average use..... pounds per acre	40	52	20	40		5	31	86	190	32	45
Planted acreage fertilized with N..... percent	100	70	80	81		50	76	88	100	100	76
Change in application rate, percent:											
+200	+37	+7	+4	+4		+4	+14	+8		+15	+7
+100	+30	+5	+2	+4		+2	+6	+8		+7	+6
+50	+15	+3	+2	+3		+1	+3	+5		+4	+3
+25	+6	+2	+1	+2		+1	+2	+3	+0.4	+2	+2
+10	+3	+1.8	+.2	+.8		+.7	+.6	+1	+.2	+.8	+.8
0, average use.....	0	0	0	0		0	0	0	0	0	0
-10	-7	-.4	-.5	-1		-.7	-.6	-.2	-.2	-.8	-1
-25	-12	-2	-1	-2		-1	-2	-10	-1	-2	-5
-50	-26	-5	-2	-6		-2	-4	-15	-6	-3	-8
-100, no application.....	-51	-10	-2	-14		-3	-6	-31	-36	-8	-16
Phosphoric oxide:											
Total use..... short tons	420	728	2,360	1,950	900	1,775	600	3,777	170	44	12,724
Average use..... pounds per acre	40	56	49	60	48	23	31	34	85	44	38
Planted acreage fertilized with P ₂ O ₅ percent	100	70	80	100	80	50	76	39	100	100	52
Change in application rate, percent:											
+200	+8	0		+0.6	+6	+10	+13	+3		+17	+6
+100	+5	0		+.6	+5	+6	+2	0	+10	+3	
+50	+5	0	+1	+.6	+3	+3	+1	0	+5	+2	
+25	+2	0	+.5	+.6	+2	+2	+.2	+.6	0	+2	+1
+10	+2	0	0	+.6	+.7	+3	+6	+2	0	+.9	+.3
0, average use.....	0	0	0	0	0	0	0	0	0	0	0
-10	-2	0	-.5	-.4	-1	-.3	-.7	-.3	-.4	-.8	-.4
-25	-5	0	-2	-1	-3	-2	-2	-.5	-.8	-2	-2
-50	-10	0	-2	-3	-10	-4	-3	-1	-2	-4	-3
-100, no application.....	-20	0	-3	-10	-34	-8	-7	-2	-5	-9	-7
Potash:											
Total use..... short tons		40		25				616			681
Average use..... pounds per acre		3		.8				6			4
Planted acreage fertilized with K ₂ O..... percent		70		8				10			15
Change in application rate, percent:											
+200				+0.2				0			+0.04
+100		0		+.1				0			+.02
+50		0		+.06				0			+.01
+25		0		+.03				0			+.006
+10		0		+.009				0			+.002
0, average use.....	0	0	0	0	0	0	0	0	0	0	0
-10		0		-.02				0			-.003
-25		0		-.04				0			-.01
-50		0		-.06				0			-.01

TABLE 107.—*Potatoes in the western region: Estimated average yield (bushels per acre) from given application rate of N, P₂O₅, and K₂O, 1950 basis*

Average fertilizer rates (pounds per acre)	Wash.	Oreg.	Idaho	Mont.	Colo.	Utah	Nev.	Calif.	Ariz.	N. Mex.	Weighted average for States reporting
Nitrogen rate:											
160	506	442	365					500	500		438
120	500	453	412	409	485	400	485	500	500	485	457
80	483	424	415	373	459	350	459	500	500	459	448
40	433	331	356	282	402	312	402	472	472	402	398
20	346	255	348	212	356	310	356	462	462	359	365
10	293	205	344	174	329	310	329	447	447	329	345
0	240	150	340	125	300	310	300	432	432	300	328
Average use (cf. table 108)	400	275	346	212	349	310	479	500	500	418	388
Phosphoric oxide rate:											
160		456		412	453	453	453	500	500	453	478
120	490	460		406	424	424	424	500	500	424	470
80	476	449	386	368	382	382	382	472	472	382	422
40	420	425	375	319	349	349	349	436	436	349	394
20	366	412	369	269	326	326	326	400	400	326	372
10	333	405	366	230	313	313	313	390	390	313	361
0	300	400	365	176	300	300	300	375	375	300	350
Average use (cf. table 108)	416	425	370	319	350	326	376	432	500	381	391
Potash rate:											
160		450						500	500		488
120	500	457						500	500		491
80	496	457	332					500	500		421
40	480	450	330					483	472		412
20	460	448	328					458	458		399
10	453	446	327					441	441		393
0	446	443	324					427	427		388
Average use (cf. table 108)	470	444	325					446	500		396

TABLE 108.—*Potatoes in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

TABLE 111.—*Fruits and nuts, and seed and specialty crops in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Fruits and nuts									Seed and specialty crops			
	Wash.	Oreg.	Idaho	Mont.	Utah	Calif.	Ariz.	N. Mex.	Weighted average for States reporting	Wash.	Oreg.	Weighted average for States reporting	
	Legume seed	Grass seed											
Acreages and yields:													
Planted acreage..... 1,000 acres.....	155	167	15	3	20	1,499	20	18	1,897	42	298	181	521
Harvested acreage..... do.....													
Total production..... 1,000 tons.....													
Do..... 1,000 pounds.....													
Average yield..... tons per acre.....													
Do..... pounds per acre.....													
Do..... percent of potential.....													
Nitrogen:													
Total use..... short tons.....	1,504	6,208	104	25	125	46,354	810	3	55,133	766	-----	3,318	4,084
Average use..... pounds per acre.....	19	74	14	17	12	62	81	0.3	58	36	-----	37	37
Planted acreage fertilized with N..... percent.....	62	54	35	56	25	-----	90	1	54	-----	-----	-----	-----
Predicted percent change in yield with change in N fertilizer rate													
Change in application rate, percent:													
+200.....	+86	+30	+14	+100	+14	+11	-----	+0.6	+19	-----	+66	+66	+66
+100.....	+55	+20	+8	+60	+8	+10	+8	+3	+14	+12	+37	+37	+32
+50.....	+27	+10	+4	+29	+5	+5	+4	+2	+7	+8	+19	+19	+17
+25.....	+13	+7	+2	+14	+3	+3	+2	+0.8	+4	+5	+10	+10	+9
+10.....	+5	+2	+0.9	+6	+1	+1	+0.2	+0.4	+1	+2	+3	+3	+3
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-6	-2	-1	-6	-1	-2	-2	-0.7	-2	-4	-6	-6	-6
-25.....	-14	-7	-3	-15	-3	-5	-4	-1	-6	-8	-10	-10	-10
-50.....	-28	-13	-6	-27	-6	-12	-8	-2	-13	-18	-21	-21	-20
-100, no application.....	-84	-37	-13	-58	-12	-25	-20	-4	-30	-35	-49	-49	-46
Phosphoric oxide:													
Total use..... short tons.....	1,617	1,605	52	-----	50	7,222	-----	4	10,550	1,199	1,032	538	2,769
Average use..... pounds per acre.....	21	19	7	-----	5	10	-----	0.4	11	57	7	6	11
Planted acreage fertilized with P ₂ O ₅ percent.....	62	54	35	66	25	-----	-----	1	53	-----	-----	-----	-----
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate													
Change in application rate, percent:													
+200.....	+0.3	+2	0	-----	0	-----	0	+1	-----	+8	+8	+8	+8
+100.....	+.3	+2	0	-----	0	-----	0	+1	-----	+3	+3	+3	+3
+50.....	+2	+8	0	-----	0	-----	0	+4	+3	+2	+2	+2	+2
+25.....	+2	+4	0	-----	0	-----	0	+3	+2	+8	+8	+8	+9
+10.....	+0.06	+2	0	-----	0	-----	0	+1	+2	+2	+2	+2	+4
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	-0.03	-2	0	-----	0	-----	0	-1	-2	-4	-4	-4	-6
-25.....	-0.08	-6	0	-----	0	-----	0	-3	-4	-8	-8	-8	-1
-50.....	-2	-1	0	-----	0	-----	0	-5	-8	-2	-2	-3	-3
-100, no application.....	-4	-4	0	-----	0	-----	0	-2	-20	-5	-----	-----	-7
Potash:													
Total use..... short tons.....	424	960	13	-----	13	3,293	-----	-----	4,703	200	-----	130	330
Average use..... pounds per acre.....	5	11	2	-----	1	4	-----	5	5	10	-----	1	3
Planted acreage fertilized with K ₂ O..... percent.....	62	54	35	25	-----	-----	-----	55	-----	-----	-----	-----	-----
Predicted percent change in yield with change in K ₂ O fertilizer rate													
Change in application rate, percent:													
+200.....	+0.3	-----	0	-----	0	-----	0	+0.2	-----	-----	-----	-----	-----
+100.....	+.2	-----	0	-----	0	-----	0	+2	-----	-----	-----	-----	-----
+50.....	+2	-----	0	-----	0	-----	0	+2	-----	-----	-----	-----	-----
+25.....	+0.08	-----	0	-----	0	-----	0	+0.06	-----	-----	-----	-----	-----
+10.....	+0.03	-----	0	-----	0	-----	0	+0.02	-----	-----	-----	-----	-----
0, average use.....	0	0	0	0	0	0	0	0	0	0	0	0	0
-10.....	0	-----	0	-----	0	-----	0	0	0	0	0	0	0
-25.....	-0.08	-----	0	-----	0	-----	0	-0.06	-----	-----	-----	-----	-----
-50.....	-2	-----	0	-----	0	-----	0	-2	-----	-----	-----	-----	-----
-100, no application.....	-3	-----	0	-----	0	-----	0	-2	-----	-----	-----	-----	-----

FERTILIZER USE AND CROP YIELDS

TABLE 112.—*Vegetables in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Wash.	Oreg.	Idaho	Colo.	Utah	Nev.	Calif.	Ariz.	N. Mex.	Weighted average for States reporting
Acreages and yields:										
Planted acreage..... 1,000 acres.....	106	90	41	155	29	1	627	75	5	1,029
Harvested acreage..... do.....	96	84	23	52	28	.8	537	89	6	915.8
Total production..... 1,000 tons.....	289	299	114	328	142	9	3,773	538	41	5,534
Average yield..... tons per acre.....	3	4	5	6	5	11	7	6	7	6
Do..... percent of potential.....										
Nitrogen:										
Total use..... short tons.....	1,109	2,090	567	622	143	13	19,340	4,000	156	28,040
Average use..... pounds per acre.....	21	46	28	23	10	26	62	107	62	54
Planted acreage fertilized with N..... percent.....	52	58	64	52	45	75	72	100	100	69
Predicted percent change in yield with change in N fertilizer rate										
Change in application rate, percent:										
+200.....	+56	+23	+19	+32	+54	+15	+13	+31	+31	+22
+100.....	+30	+15	+19	+20	+28	+12	+9	+13	+17	+14
+50.....	+16	+8	+11	+12	+14	+11	+5	+11	+9	+8
+25.....	+10	+5	+7	+7	+7	+8	+3	+8	+5	+5
+10.....	+3	+2	+2	+3	+3	+3	+1	+3	+2	+2
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10.....	-4	-2	-2	-5	-3	-7	-1	-3	-2	-2
-25.....	-12	-6	-8	-8	-7	-16	-3	-8	-4	-5
-50.....	-22	-11	-16	-13	-15	-31	-7	-16	-8	-10
-100, no application.....	-47	-20	-40	-32	-32	-63	-17	-27	-13	-23
Phosphoric oxide:										
Total use..... short tons.....	1,388	2,090	981	323	257	18	15,169	1,500	119	21,845
Average use..... pounds per acre.....	26	46	48	12	18	36	48	40	48	42
Planted acreage fertilized with P ₂ O ₅ percent.....	52	58	64	54	45	75	63	100	100	63
Predicted percent change in yield with change in P ₂ O ₅ fertilizer rate										
Change in application rate, percent:										
+200.....	+29	+12	+20	+21	+34	+12	+2	+0.5	+0.2	+8
+100.....	+19	+6	+10	+12	+22	+12	+2	+1	+1.8	+6
+50.....	+10	+4	+10	+5	+10	+8	+1	+2	+1	+3
+25.....	+5	+2	+6	+3	+6	+4	+6	+1	+1.8	+2
+10.....	+2	.4	+2	+1	+3	+2	+2	+1.8	+2	+1.6
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10.....	-2	-.5	-2	-.8	-3	-2	-3	-.5	-.3	-.7
-25.....	-6	-2	-6	-3	-6	-5	-7	-1	-1	-2
-50.....	-14	-3	-15	-7	-11	-15	-2	-2	-2	-4
-100, no application.....	-29	-6	-37	-14	-25	-41	-6	-4	-4	-10
Potash:										
Total use..... short tons.....	971	1,125	280	.....	23	.....	5,241	1,600	.....	9,240
Average use..... pounds per acre.....	18	25	14	.....	2	.....	17	43	.....	19
Planted acreage fertilized with K ₂ O..... percent.....	52	58	64	55	11	.....	41	100	.....	49
Predicted percent change in yield with change in K ₂ O fertilizer rate										
Change in application rate, percent:										
+200.....	+18	.....	.....	.....	+4	.....	+0.6	+1	.....	+3
+100.....	+11	.....	.....	.....	+2	.....	+1.4	+1.5	.....	+2
+50.....	+7	.....	.....	.....	+1	.....	+1.3	+1.4	.....	+1
+25.....	+3	.....	.....	.....	+6	.....	+2	+1.3	.....	+1.6
+10.....	+1	.....	.....	.....	+3	.....	+0.08	+1.1	.....	+1.2
0, average use.....	0	0	0	0	0	0	0	0	0	0
-10.....	-2	.....	.....	.....	-.3	.....	-.09	-.1	.....	-.3
-25.....	-5	.....	.....	.....	-.6	.....	-.2	-.3	.....	-.8
-50.....	-9	.....	.....	.....	-1	.....	-.6	-.4	.....	-2
-100, no application.....	-18	.....	.....	.....	-2	.....	-2	-1	.....	-4

¹ Revised.

FERTILIZER USE AND CROP YIELDS

TABLE 115.—*Pasture and cover crops in the western region: Estimated percentage change in yield resulting from increases or decreases from average application rate of N, P₂O₅, and K₂O, 1950 basis*

Acreages, yields, and fertilizer use	Wash.	Oreg.	Idaho	Mont.	Utah	Nev.	Calif.	N. Mex.	Weighted average for States reporting
Acreages and yields:									
Planted acreage.....	1,000 acres..								
Harvested acreage.....	do.....								
Total production.....	1,000 tons..								
Average yield.....	tons per acre..								
Do.....	percent of potential								
Nitrogen:									
Total use.....	short tons..								
Average use.....	pounds per acre..								
Planted acreage fertilized with N.....	percent..								
Change in application rate, percent:									
+200.....									
+100.....									
+50.....									
+25.....									
+10.....									
0, average use.....									
-10.....									
-25.....									
-50.....									
-100, no application.....									
Phosphoric oxide:									
Total use.....	short tons..								
Average use.....	pounds per acre..								
Planted acreage fertilized with P ₂ O ₅	percent..								
Change in application rate, percent:									
+200.....									
+100.....									
+50.....									
+25.....									
+10.....									
0, average use.....									
-10.....									
-25.....									
-50.....									
-100, no application.....									
Potash:									
Total use.....	short tons..								
Average use.....	pounds per acre..								
Planted acreage fertilized with K ₂ O.....	percent..								
Change in application rate, percent:									
+200.....									
+100.....									
+50.....									
+25.....									
+10.....									
0, average use.....									
-10.....									
-25.....									
-50.....									
-100, no application.....									

O